

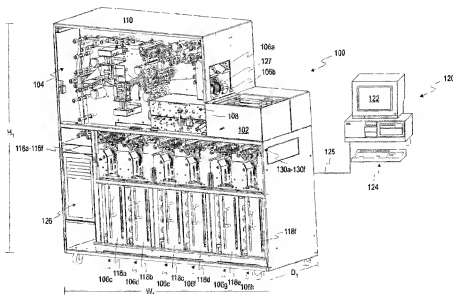
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[Continued on next page]

(54) **Title:** CURRENCY HANDLING SYSTEM HAVING MULTIPLE OUTPUT RECEPTACLES

(57) **Abstract:** An apparatus for transferring a plurality of documents (204) from a first compartment (116) to a second compartment (118). The apparatus comprises a plunger assembly (300) having a paddle (302) adapted to contact the documents (204), and at least one outwardly extending arm (306, 308) hingedly connected to the plunger assembly (300). A gate (210) is disposed between the first compartment (116) and the second compartment (118) forming a document supporting surface. The gate has an open position and a closed position. At least one lever (216, 217) extends from the gate, the lever (216, 217) being in a first position when the gate is in the closed position and the lever being in a second position when the gate is in the open position. The gate (210) moves from the closed position to the open position when the paddle (302) urges the documents (204) against the gate (210) from the first compartment (116) towards the second compartment (118). The arm (306, 308) moves the lever (216, 217) from the second position to the first position to move the gate (210) from the open position to the closed position when the paddle (302) retracts from the second compartment (118) to the first compartment (116).

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## CURRENCY HANDLING SYSTEM HAVING MULTIPLE OUTPUT RECEPTACLES

### FIELD OF THE INVENTION

The present invention relates generally to the field of currency handling systems and, more particularly, to a multi-pocket currency handling system for discriminating, authenticating, and/or counting currency bills.

### 5 BACKGROUND OF THE INVENTION

A variety of techniques and apparatuses have been used to satisfy the requirements of automated currency handling machines. As businesses and banks grow, these businesses are experiencing a greater volume of paper currency. These businesses are continually requiring not only that their currency be processed more quickly but, also, processed with more options  
10 in a less expensive manner. At the upper end of sophistication in this area of technology are machines that are capable of rapidly identifying, discriminating, and counting multiple currency denominations and then delivering the sorted currency bills into a multitude of output compartments. Many of these high end machines are extremely large and expensive such that they are commonly found only in large institutions. These machines are not readily available to  
15 businesses which have monetary and space budgets, but still have the need to process large volumes of currency. Other high end currency handling machines require their own climate controlled environment which may place even greater strains on businesses having monetary and space budgets.

Currency handling machines typically employ magnetic sensing or optical sensing for  
20 denominating and authenticating currency bills. The results of these processes determines to which output compartment a particular bill is delivered to in a currency handling device having multiple output receptacles. For example, ten dollar denominations may be delivered to one output compartment and twenty dollar denominations to another, while bills which fail the authentication test are delivered to a third output compartment. Unfortunately, many prior art  
25 devices only have one output compartment which can be appropriately called a reject pocket. Accordingly, in those cases, the reject pocket may have to accommodate those bills which fail a denomination test or authentication test. As a result, different types of "reject" bills are stacked upon one another in the same output compartment leaving the operator unknowing as to which of those bills failed which tests.

Many prior art large volume currency handling devices which positively transport the currency bills through the device are susceptible to becoming jammed. And many of these machines are difficult to un-jam because the operator must physically remove the bill from the device. If necessary, the operator can often manipulate a hand-crank to manually jog the device to remove the bills. Then, the operator must manually turn the hand crank to flush out all the bills from within the system before the batch can be reprocessed. Further compounding the problem in a jam situation is that many prior art devices are not equipped to detect the presence of a jam. In such a situation, the device continues to operate until the bills pile up and the jam is so severe that the device is forced to physically halt. This situation can cause physical damage to both the machine and the bills.

Often, a bill jam ruins the integrity of the count and/or valuation of the currency bills requiring that the entire batch, including those bill already processed into holding and/or storage areas, be reprocessed. Bills need to be reprocessed because prior art devices do not maintain several running totals of bills as bills pass various points within the device. Removing bills from the holding areas and/or storage areas is a time consuming process. For example, a prior device may only count the bills as they are transported through an evaluation region of the currency handling machine. Bills exiting the evaluation region are included in the totals regardless of whether they are involved in bill jams or are successfully transported to an output receptacle. Therefore, when a bill jam occurs those bills involved in the bill jam as well as those bills already transported to the storage areas and/or storage areas have to be reprocessed.

Weight is another draw-back of prior art high-volume currency handling machines. In part, the weight of these machines is due to the heavy machinery used. For example, some machines contain large cast iron rails on which apparatuses ride to push currency bills down into the storage compartments. Unfortunately, the increased weight of these machines often translates into increased costs associated with the machine.

Another disadvantage to some prior art currency handling devices is the manner of feeding bills into the device. Many prior art devices only have one advance mechanism so the operator of the device can only process one stack of bills at a time before reloading the machine. Alternatively, the operator can attempt to simultaneously manipulate the stack of bills currently being processed, a new stack of bills, and the feeder mechanism.

Typically, in the handling of bulk currency, after the currency bills have been analyzed, denominated, authenticated, counted and/or otherwise processed, the currency bills are strapped. Bill strapping is a process whereby a stack of a specific number of bills of a single denomination are secured with a paper strap. For example, one dollar bills are segregated into stacks of one-hundred \$1 bills and then bound with a paper strap. Strapping facilitates the handling of currency by allowing the strapped stacks of bills to be counted rather than the individual currency bills. Traditionally, U.S. currency bills are strapped in one-hundred bill stacks.

The task of bill strapping can increase the amount of time required to process a given batch of currency. Some currency handling machines are able to segregate currency bills into individual denominations, then the operator must manually count the bills into smaller batches for strapping purposes. In other situations, a currency handling device may suspend operation after a predetermined number of bills of a given denomination have been delivered to an output receptacle at which time the operator can remove those bills from the output receptacle and bind the bills with a paper strap. However, this manner of strapping can increase the time required to process a batch of currency bills. Higher end currency processing machines are capable of strapping bills. However, there is an increased cost associated with these higher end machines.

During the lifetime of prior art currency handling devices it is likely that individual key components of the devices, including components specific to the output receptacles, will degrade and eventually fail. The failure of an individual components specific to an output receptacle can render that output receptacle inoperable. The inoperability of one of the output receptacles of prior art currency handling devices can render the entire device inoperable regardless of whether the remaining output receptacles are otherwise properly functioning. Component failures resulting in the inoperability of the entire device can have a devastating effect on the cash handling operations of users of these devices. The inventors of the present invention have found that currency handling devices play a vital role in the overall operation of a cash vault, including cash vaults at bank or casinos. The inventors estimate that over 90% (ninety percent) of the cash handled within a cash vault is processed by a currency handling device. Therefore, the failure of a currency handling device can have a disastrous effect on the operation of a cash vault or other operations relying on the performance of the currency handling device.

**SUMMARY OF THE INVENTION**

According to one embodiment of the present invention, there is provided a multiple output receptacle currency handling device for receiving a stack of currency bills and rapidly processing all the bills in the stack. One aspect of the present invention is directed to an apparatus for transferring items from a first compartment to a second compartment. The apparatus comprises a plunger assembly having a paddle, an arm, a gate, and a lever. The arm is hingedly connected to the plunger assembly. The gate is disposed between the first compartment and the second compartment, and has an open position and a closed position. The lever extends from the gate, and is in a first position when the gate is in the closed position and in a second position when the gate is in the open position. The gate moves from the closed position to the open position when the paddle moves against the gate or documents stacked upon the gate while descending from the first compartment to the second compartment. The arm moves the lever from the second position to the first position to move the gate from the open position to the closed position when the paddle ascends from the second compartment to above the first compartment.

According to one embodiment of the present invention, there is provided a multiple output receptacle currency handling device for receiving a stack of currency bills and rapidly processing all the bills in the stack. One aspect of the present invention is directed to an apparatus for rotating a bill approximately 180°. The apparatus comprises a first and a second belt. The first belt has a bill transport portion, a return portion, a first end, and a second end. The second end of first belt being twisted approximately 180° in relation to the first end of the first belt. The second belt has a bill transport portion, a return portion, a first end, and second end. The bill transport portion of the first belt is disposed adjacent to the bill transport portion of the second belt. The second end of second belt is twisted approximately 180° in relation to the first end of the second belt. A bill transport path is defined by the bill transport portions of the first and the second belts. The bill transport path has an inlet and an outlet. The outlet of the bill transport path is twisted approximately 180° in relation to the inlet. A plurality of guides are disposed adjacent to the bill facing path for supporting the outer portions of the bill which extend beyond a width of the first and the second belts as the bill is being transported along the transport path.

According to one embodiment of the present invention, there is provided a method and device for identifying small stacks of currency bills within a larger stack of currency bills using a currency evaluation device. A batch of currency bills to be processed are received in an input receptacle and are transported from the input receptacle, one at a time, past an evaluating unit to at least one output receptacle. The evaluating unit determines information concerning each of the bills including the face orientation of each of the bills. Next it is determined whether the face orientation of each of the bills matches a target face orientation. If the face orientation of a bill matches the target orientation, the face orientation of that bill is maintained. If the face orientation of a bill fails to match the target orientation, the face orientation of that bill is reversed with a bill facing mechanism. Each of the bills are then stacked in the output receptacle. After a predetermined number of bills having a common face orientation are stacked in the output receptacle, the target face orientation is redefined. The bills continue to be processed in this manner until each of the bills are transported from the input receptacle.

According to one embodiment of the present invention, there is provided a method and apparatus for handling bill jams within a currency processing device is provided. The device includes a transport mechanism adapted to transport bills along a transport path, one at a time, from the input receptacle past an evaluation unit into a plurality of output receptacles. At least one of the output receptacles includes a holding area and a storage area. A plurality of bill passage sensors are sequentially disposed along the transport path that are adapted to detect the passage of a bill as each bill is transported past each sensor. An encoder is adapted to produce an encoder count for each incremental movement of the transport mechanism. A controller counts the total number of bills transported into each of the holding areas and the total number of bills moved from a holding area to a corresponding storage area after a predetermined number of bills have been transported into the holding area. The controller tracks the movement of each of the bills along the transport path into each of the holding areas with the plurality of bill passage sensors. The presence of a bill jam is detected when a bill is not transported past one of the plurality of bill passage sensors within a requisite number of encoder counts. The operation of the transport mechanism is suspended upon detection of a bill jam. The bills from each of the holding areas are moved to the corresponding storage areas upon suspension of the operation of the transport mechanism. Remaining bills are then flushed from the transport path after moving the bills from each of the

holding areas to the corresponding holding areas upon suspension of the operation of the transport mechanism.

According to one embodiment of the present invention, there is provided a currency handling device for rapidly processing a plurality of currency bills comprises an input  
5 receptacle adapted to receive the currency bills to be processed, a plurality of output receptacles adapted to receive the bills after the bills have been processed, a transport mechanism adapted to transport the bills, one at a time, along a transport path from the input receptacle to the plurality of output receptacles, an evaluating unit that is adapted to determine information concerning the bills, and a controller. The evaluation unit includes at  
10 least one sensor positioned along the transport path between the input receptacle and the plurality of output receptacles. The controller is adapted to operate the currency handling device according to a mode of operation wherein the mode of operation designates the output receptacle to which each of the bills are transported based on the determined information concerning the bill. The controller is adapted to disable at least one of the plurality of output  
15 receptacles. The controller is adapted to cause the transport mechanism to direct bills directed to the disabled one of the plurality of output receptacles pursuant to the mode of operation to an alternative output receptacle.

The above summary of the present invention is not intended to represent each embodiment, or every aspect, of the present invention. Additional features and benefits of  
20 the present invention will become apparent from the detail description, figures, and claim set forth below.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Other objects and advantages of the invention will become apparent upon reading the following detailed description in conjunction with the drawings in which:

25 FIG. 1a is a perspective view of a document handling device according to one embodiment of the invention;

FIG. 1b is a front view of a document handling device according to one embodiment of the invention;

30 FIG. 2a is a perspective view of an evaluation region according to one embodiment of the document handling device of the present invention;

FIG. 2b is a side view of an evaluation region according to one embodiment of the document handling device of the present invention;



FIG. 3a is a perspective view of an input receptacle according to one embodiment of the document handling device of the present invention;

FIG. 3b is another perspective view of an input receptacle according to one embodiment of the document handling device of the present invention;

5       FIG. 3c is a top view of an input receptacle according to one embodiment of the document handling device of the present invention;

FIG. 3d is a side view of an input receptacle according to one embodiment of the document handling device of the present invention;

10       FIG. 4 is a perspective view of a portion of a transportation mechanism according to one embodiment of the present invention;

FIG. 5 is a front perspective view of an escrow compartment, a plunger assembly, and a storage cassette according to one embodiment of the document handling device of the present invention;

15       FIG. 6 is a top view of an escrow compartment and plunger assembly according to one embodiment of the document handling device of the present invention;

FIG. 7 is a front view of an escrow compartment and plunger assembly according to one embodiment of the document handling device of the present invention;

FIG. 8 is another front view of an escrow compartment and plunger assembly according to one embodiment of the document handling device of the present invention;

20       FIG. 9 is a perspective view of an apparatus for transferring currency from an escrow compartment to a storage cassette according to one embodiment of the document handling device of the present invention;

FIG. 10 is a perspective view of a paddle according to one embodiment of the document handling device of the present invention;

25       FIG. 11 is a rear perspective view of the escrow compartment, plunger assembly, and storage cassette according to one embodiment of the document handling device of the present invention;

FIG. 12 is a rear view of a plunger assembly wherein the gate is in the open position according to one embodiment of the document handling device of the present invention;

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FIG. 13 is a rear view of a plunger assembly wherein the gate is in the closed position according to one embodiment of the document handling device of the present invention;

FIG. 14 is a perspective view of a storage cassette according to one embodiment  
5 of the document handling device of the present invention;

FIG. 15 is a rear view of a storage cassette according to one embodiment of the document handling device of the present invention;

FIG. 16 is a perspective view of a storage cassette where the door is open according to one embodiment of the document handling device of the present invention;

FIG. 17a is a top view of a storage cassette sized to accommodate United States  
10 currency documents according to one embodiment of the document handling device of the present invention;

FIG. 17b is a rear view of a storage cassette sized to accommodate United States currency documents according to one embodiment of the document handling device of the  
15 present invention;

FIG. 18a is a top view of a storage cassette sized to accommodate large documents according to one embodiment of the document handling device of the present invention;

FIG. 18b is a rear view of a storage cassette sized to accommodate large  
20 documents according to one embodiment of the document handling device of the present invention;

FIG. 19 is a perspective view of a two belt bill facing mechanism according to one embodiment of the document handling device of the present invention;

FIG. 20 is another perspective view of a two belt bill facing mechanism according  
25 to one embodiment of the document handling device of the present invention;

FIG. 21 is a perspective view of a two belt bill facing mechanism without belt guides or bill guides according to one embodiment of the document handling device of the present invention;

FIG. 22 is a perspective view of a two belt bill facing mechanism without belt  
30 guides according to one embodiment of the document handling device of the present invention;

FIG. 23 is a front view of a stack of currency bills stacked pursuant to a strapping mode of operation according to one embodiment of the document handling device of the present invention;

FIG. 24 is a flow charting illustrating the steps performed when operating  
5 pursuant to a strapping mode of operation according to one embodiment of the document handling device of the present invention;

FIG. 25a is a front view of a stack of currency bills stacked pursuant to a strapping mode of operation according to one embodiment of the document handling device of the present invention;

10 FIG. 25b is a front view of a stack of currency bills stacked pursuant to a strapping mode of operation according to one embodiment of the document handling device of the present invention;

FIG. 26 is a functional block diagram according to one embodiment of the document handling device of the present invention;

15 FIG. 27 is a flow chart of the disable pockets routine according to one embodiment of the document handling device of the present invention;

FIG. 28 is a flow chart of the disable pockets routine according to an alternative embodiment of the document handling device of the present invention; and

FIGS. 29-31 are illustrative screens that are displayed on a user interface pursuant  
20 to the disable pockets routine according to one embodiment of the document handling device of the present invention.

#### **DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS**

Referring to FIGS. 1a and 1b, a multi-pocket document processing device 100 such as a currency handling device according to one embodiment of the present invention  
25 is illustrated. Currency bills are fed, one by one, from a stack of currency bills placed in an input receptacle 102 into a transport mechanism 104. The transport mechanism 104 guides currency bills to one of a plurality of output receptacles 106a-106h, which may include upper output receptacles 106a, 106b, as well as lower output receptacles 106c-106h. Before reaching an output receptacle 106 the transport mechanism 104 guides the  
30 bill through an evaluation region 108 where a bill can be, for example, analyzed, authenticated, denominated, counted, and/or otherwise processed. In alternative embodiments of the currency handling device 100 of the present invention, the evaluation

region 108 can determine bill orientation, bill size, or whether bills are stacked upon one another. The results of the above process or processes may be used to determine to which output receptacle 106 a bill is directed. The illustrated embodiment of the currency handling device has an overall width,  $W_1$ , of approximately 4.52 feet (1.38 meters), a height,  $H_1$ , of approximately 4.75 feet (1.45 meters), and a depth,  $D_1$ , of approximately 1.67 feet (0.50 meters).

In one embodiment, documents such as currency bills are transported, scanned, denominated, authenticated and/or otherwise processed at a rate equal to or greater than 500 bills per minute. In another embodiment, documents such as currency bills are transported, scanned, denominated, authenticated, and/or otherwise processed at a rate equal to or greater than 800 bills per minute. In another embodiment, documents such as currency bills are transported, scanned, denominated, authenticated and/or otherwise processed at a rate equal to or greater than 1000 bills per minute. In still another embodiment, documents such as currency bills are transported, scanned, denominated, authenticated, and/or otherwise processed at a rate equal to or greater than 1200 bills per minute.

In the illustrated embodiment, interposed in the bill transport mechanism 104, intermediate the bill evaluation region 108 and the lower output receptacles 106c-106h is a bill facing mechanism designated generally by reference numeral 110. The bill facing mechanism is capable of rotating a bill  $180^\circ$  so that the face position of the bill is reversed. That is, if a U.S. bill, for example, is initially presented with the surface bearing a portrait of a president facing down, it may be directed to the facing mechanism 110, whereupon it will be rotated  $180^\circ$  so that the surface with the portrait faces up. The leading edge of the bill remains constant while the bill is being rotated  $180^\circ$  by the facing mechanism 110. The decision may be taken to send a bill to the facing mechanism 110 when the selected mode of operation or other operator instructions call for maintaining a given face position of bills as they are processed by the currency handling device 100. For example, it may be desirable in certain circumstances for all of the bills ultimately delivered to the lower output receptacles 106c-106h to have the bill surface bearing the portrait of the president facing up. In such embodiments of the currency handling device 100, the bill evaluation region 108 is capable of determining the face position of a bill, such that a bill not having the desired face position can first be directed to the facing mechanism 110 before being

delivered to the appropriate output receptacle 106. Further details of a facing mechanism which may be utilized for this purpose are disclosed in U.S. Patent No. 6,074,334, entitled "Document Facing Method and Apparatus", incorporated herein by reference in its entirety, which may be employed in conjunction with the present invention such as the device illustrated in FIGS. 1a and 1b. Other alternative embodiments of the currency handling device 100 do not include the facing mechanism 110.

The currency handling device 100 in FIG. 1a may be controlled from a separate controller or control unit 120 which has a display/user-interface 122, which may incorporate a touch panel display in one embodiment of the present invention, which displays information, including "functional" keys when appropriate. The display/user-interface 122 may be a full graphics display. Alternatively, additional physical keys or buttons, such as a keyboard 124, may be employed. The control unit 120 may be a self-contained desktop or laptop computer which communicates with the currency handling device 100 via a cable 125. The currency handling device 100 may have a suitable communications port (not shown) for this purpose. In embodiments in which the control unit 120 is a desktop computer wherein the display/user-interface 122 and the desktop computer are physically separable, the desktop computer may be stored within a compartment 126 of the currency handling device 100. In other alternative embodiments, the control unit 120 is integrated into the currency handling device 100 so the control unit 120 is contained within the device 100.

The operator can control the operation of the currency handling device 100 through the control unit 120. Through the control unit 120 the operator can direct the bills into specific output receptacles 106a-106h by selecting various user defined modes. In alternative embodiments, the user can select pre-programmed user defined modes or create new user defined modes based on the particular requirements of the application. For example, the operator may select a user defined mode which instructs the currency handling device 100 to sort bills by denomination; accordingly, the evaluation region 108 would denominate the bills and direct one dollar bills into the first lower output receptacle 106c, five dollar bills into the second lower output receptacle 106d, ten dollar bills into the third lower output receptacle 106e, twenty dollar bills into the forth lower output receptacle 106f, fifty dollar bills into the fifth lower output receptacle 106g, and one-hundred dollar bills into the sixth lower output receptacle 106h. The operator may also

instruct the currency handling device 100 to deliver those bills whose denomination was not determined, no call bills, to the first upper output receptacle 106a. In such an embodiment, upper output receptacle 106a would function as a reject pocket. In an alternative embodiment, the operator may instruct the currency handling device 100 to also evaluate the authenticity of each bill. In such an embodiment, authentic bills would be directed to the appropriate lower output receptacle 106c-106h. Those bills that were determined not to be authentic, suspect bills, would be delivered to the second upper output receptacle 106b. A multitude of user defined modes are disclosed by PCT Publication No. WO 99/09511 entitled "Multi-Pocket Currency Discriminator" which was filed on August 21, 1997, incorporated herein by reference in its entirety, which may be employed in conjunction with the present invention such as the device illustrated in FIGS. 1a and 1b.

According to one embodiment, the currency handling device 100 is designed so that when the evaluation region 108 is unable to identify certain criteria regarding a bill, the unidentified note is flagged and "presented" in one of the output receptacles 106a-106h, that is, the transport mechanism 104 is stopped so that the unidentified bill is located at a predetermined position within one of the output receptacles 106a-106h, such as being the last bill transported to one of the output receptacles. Such criteria can include denominating information, authenticating information, information indicative of the bill's series, or other information the evaluation region 108 is attempting to obtain pursuant to a mode of operation. Which output receptacles 106a-106h the flagged bill is presented in may be determined by the user according to a selected mode of operation. For example, where the unidentified bill is the last bill transported to an output receptacle 106a-106h, it may be positioned within a stacker wheel or positioned at the top of the bills already within the output receptacle 106a-106h. While unidentified bills may be transported to any output receptacles 106a-106h, it may be more convenient for the operator to have unidentified bills transported to one of the upper output receptacles 106a, b where the operator is able to easily see and/or inspect the bill which has not been identified by the evaluation region 108. The operator may then either visually inspect the flagged bill while it is resting on the top of the stack, or alternatively, the operator may decide to remove the bill from the output receptacle 106 in order to examine the flagged bill more closely. In an alternative embodiment of the currency handling device 100, the

device 100 may communicate to the user via the display/user-interface 122 in which one of the output receptacles 106a-106h a flagged bill is presented.

The currency handling device 100 may be designed to continue operation automatically when a flagged bill is removed from the upper output receptacle 106a, b or, according to

- 5 one embodiment of the present invention, the device 100 may be designed to suspend operation and require input from the user via the control unit 120. Upon examination of a flagged bill by the operator, it may be found that the flagged bill is genuine even though it was not identified as so by the evaluation region 108 or the evaluation may have been unable to denominate the flagged bill. However, because the bill was not identified, the
- 10 total value and/or denomination counters will not reflect its value. According to one embodiment, such an unidentified bill is removed from the output receptacles 106 and reprocessed or set aside. According to another embodiment, the flagged bills may accumulate in the upper output receptacles 106a, b until the batch of currency bills currently being processed is completed or the output receptacle 106a, b is full and then
- 15 reprocessed or set aside.

According to another embodiment, when a bill is flagged, the transport mechanism may be stopped before the flagged bill is transported to one of the output receptacles.

Such an embodiment is particularly suited for situations in which the operator need not examine the bill being flagged; for example, the currency handling device 100 is instructed

- 20 to first process United States currency and then British currency pursuant to a selected mode of operation where the currency handling device 100 processes United States \$1, \$5, \$10, \$20, \$50, and \$100 currency bills into the lower output receptacles 106c-106h, respectively. Upon detection of the first British pound note, the currency handling device 100 may halt operation allowing the operator to empty the lower output receptacles 106c-
- 25 106h and to make any spatial adjustments necessary to accommodate the British currency. A multitude of modes of operation are described in conjunction with bill flagging, presenting, and/or transport halting in PCT WO 97/45810 entitled "Method and Apparatus for Document Processing", incorporated herein by reference in its entirety above, which may be employed in conjunction with the present invention such as the
- 30 device illustrated in FIGS. 1a and 1b.

In the illustrated embodiment, with regard to the upper output receptacles 106a, 106b, the second upper output receptacle 106b is provided with a stacker wheel 127 for

accumulating a number of bills, while the first upper output receptacle 106a is not provided with such a stacker wheel. Thus, when pursuant to a preprogrammed mode of operation or an operator selected mode or other operator instructions, a bill is to be fed to the first upper output receptacle 106a, there may be a further instruction to momentarily  
5 suspend operation of the currency handling device 100 for the operator to inspect and remove the bill. On the other hand, it may be possible to allow a small number of bills to accumulate in the first upper output receptacle 106a prior to suspending operation. Similarly, the second upper output receptacle 106b may be utilized initially as an additional one of the lower output receptacles 106c-106h. However, there is no storage  
10 cassette associated with the second upper output receptacle 106b. Therefore, when the second upper output receptacle 106b is full, operation may be suspended to remove the bills at such time as yet further bills are directed to the second upper output receptacle 106b in accordance with the selected mode of operation or other operator instructions. In an alternative embodiment of the currency handling device 100 both the first and the  
15 second upper output receptacles 106a, 106b are equipped with a stacker wheel. In such an embodiment both the upper output receptacles 106a, b may also function as the lower output receptacle 106c-106h allowing a number of bills to be stacked therein.

FIGS. 2a and 2b illustrate the evaluation region 108 according to one embodiment of the currency handling system 100. The evaluation region can be opened for service,  
20 access to sensors, clear bill jams, *etc.* as shown in FIG. 2a. The characteristics of the evaluation region 108 may vary according to the particular application and needs of the user. The evaluation region 108 can accommodate a number and variety of different types of sensors depending on a number of variables. These variables are related to whether the machine is authenticating, counting, or discriminating denominations and  
25 what distinguishing characteristics are being examined, *e.g.* size, thickness, color, magnetism, reflectivity, absorbability, transmissivity, electrical conductivity, *etc.* The evaluation region 108 may employ a variety of detection means including, but not limited to, a size detection and density sensor 408, a lower 410 and an upper 412 optical scan head, a single or multitude of magnetic sensors 414, a thread sensor 416, and an  
30 ultraviolet/fluorescent light scan head 418. These detection means and a host of others are disclosed in PCT WO99/09511 entitled "Multi-Pocket Currency Discriminator," incorporated by reference above.



The direction of bill travel through the evaluation region 108 is indicated by arrow

- A. The bills are positively driven along a transport plate 400 through the evaluation region 108 by means of a transport roll arrangement comprising both driven rollers 402 and passive rollers 404. The rollers 402 are driven by a motor (not shown) via a belt 401.
- 5 Passive rollers 404 are mounted in such a manner as to be freewheeling about their respective axis and biased into counter-rotating contact with the corresponding driven rollers 402. The driven and passive rollers 402, 404 are mounted so that they are substantially coplanar with the transport plate 400. The transport roll arrangement also includes compressible rollers 406 to aid in maintaining the bills flat against the transport
- 10 plate 400. Maintaining the bill flat against the transport plate 400 so that the bill lies flat when transported past the sensors enhances the overall reliability of the evaluation processes. A similar transport arrangement is disclosed in commonly-owned United States Patent No. 5,687,963 entitled "Method and Apparatus for Discriminating and Counting Documents," which is incorporated herein by reference in its entirety.
- 15 Referring now to FIGS. 3a-3d, the input receptacle 102 of the currency handling device 100 is illustrated. A feeder mechanism such as a pair of stripping wheels 140 aid in feeding the bills in seriatim to the transport mechanism 104 which first carries the bills through the evaluation region 108. According to one embodiment, the input receptacle 102 includes at least one spring-loaded feeder paddle 142a which is pivotally mounted,
- 20 permitting it to be pivoted upward and drawn back to the rear of a stack of bills placed in the input receptacle 102 so as to bias the bills towards the evaluation region 108 via the pair of stripping wheels 140. The paddle 142a is coupled to an advance mechanism 144 to urge the paddle 142a towards the stripping wheels 140. In the illustrated embodiment, motion is imparted to the advance mechanism via a spring 145. In other alternative
- 25 embodiments, the advance mechanism 144 is motor driven. The advance mechanism 144 is slidably mounted to a shaft 146. The advance mechanism 144 also constrains the paddle 142a to a linear path. The advance mechanism 144 may contain a liner bearing (not shown) allowing the paddle 142a to easily slide along the shaft 146. In the embodiment illustrated, the paddle 142a may also contain channels 148 to aid in
- 30 constraining the paddle 142a to a linear path along a pair of tracks 150. The paddle 142a may additionally include a roller 152 to facilitate the movement of the paddle 142a.

In the embodiment illustrated in FIGS. 3a-3d, a second paddle 142b is provided such that a second stack of bills 147 may be placed in the input receptacle 102 behind a first group of bills 149, while the first group of bills 149 is being fed into the currency handling device 100. Thus, the two feeder paddles 142a and 142b may be alternated

5 during processing in order to permit multiple stacks of currency bills to be loaded into the input receptacle 102. In such an embodiment, the operator would retract paddle 142a and place a stack of bills into the input receptacle. Once inside the input receptacle, the operator would place the paddle 142a against the stack of bills so that the paddle 142a biases the stack of bills towards the pair of stripper wheels 140. The operator could then

10 load a second stack of bills into the input receptacle 102 by retracting the second paddle 142b and placing a stack of bills in the input receptacle between the paddles 142a and 142b. The second paddle 142b urges the second stack of bills up against the backside of the first paddle 142a. The operator can then upwardly rotate the first paddle 142a thus combining the two stacks. The first paddle 142a is then retracted to the rear of the input

15 receptacle and the process can be repeated. The two paddle input receptacle allows the operator to more easily continuously feed stacks of bills to the currency handling device 100. In devices not having two feeder paddles, the operator is forced to awkwardly manipulate the two stacks of bills and the advance mechanism. Alternatively, the operator may wait for the stack of bills to be processed out of the input receptacle to add another

20 stack; however, waiting to reload until each stack is processed adds to the total time to process a given amount of currency.

Referring to FIG. 4, a portion of the transport mechanism 104 and diverters 130a-130d are illustrated. A substantial portion of the transport path of the currency handling device 100 positively grips the bills during transport from the pair of stripping wheels 140

25 through the point where bills are delivered to upper output receptacle 106a or are delivered to the stacker wheels 202 of output receptacles 106b-106h. The positive grip transport path of the currency handling device 100 is less costly and weighs less than the vacuum transport arrangements of prior currency processing devices.

The transport mechanism 104 is electronically geared causing all sections to move

30 synchronously from the evaluation region 108 through the point where the bills are delivered to the output receptacles 106. Multiple small motors are used to drive the transport mechanism 104. Using multiple small, less costly motors is more efficient and

less costly than a single large motor. Further, less space is consumed enabling the currency handling device 100 to be more compact. Electronically gearing the transport mechanism 104 enables a single encoder to monitor bill transportation within the currency handling system 100. The encoder is linked to the bill transport mechanism 104 and

5 provides input to a processor to determine the timing of the operations of the currency handling device 100. In this manner, the processor is able to monitor the precise location of the bills as they are transported through the currency handling device 100. This process is termed "flow control." Input from additional sensors 119 located along the transport mechanism 104 of the currency handling device 100 enables the processor to

10 continually update the position of a bill within the device 100 to accommodate for bill slippage. When a bill leaves the evaluation region 108 the processor expects the bill to arrive at the diverter 130a corresponding to the first lower output receptacle 106c after a precise number of encoder counts. Specifically, the processor expects the bill to flow past each sensor 119 positioned along the transport mechanism 104 at a precise number of

15 encoder counts. If the bill slips during transport but passes a sensor 119 later within an acceptable number of encoder counts the processor updates or "re-queues" the new bill position. The processor calculates a new figure for the time the bill is expected to pass the next sensor 119 and arrive at the first diverter 130a. The processor activates a the one of the diverters 130a-f to direct the bill into the appropriate corresponding lower

20 output receptacle 106c-106h when the sensor 119 immediately preceding the diverter 130 detects the passage of the bill to be directed into the appropriate lower output receptacle 106c-h.

The currency handling device 100 also uses flow control to detect jams within the transport mechanism 104 of the device 100. When a bill does not reach a sensor 119

25 within in the calculated number of encoder counts plus the maximum number of counts allowable for slippage, the processor suspends operation of the device 100 and informs the operator via the display/user-interface 122 that a jam has occurred. The processor also notifies the operator via the display/user-interface 122 of the location of the jam by indicating the last sensor 119 that the bill passed and generally the approximate location

30 of the jam in the system. If the operator cannot easily remove the bill without damage, the operator can then electronically jog the transport path in the forward or reverse direction via the control unit 120 so that the jammed bill is dislodged and the operator can

easily remove the bill from the transport path. The operator can then flush the system causing the transport mechanism 104 to deliver all of the bills currently within the transport path of the currency handling device 100 to one of the output receptacles 106. In an alternative embodiment, the user of the currency handling device 100 would have

5 the option when flushing the system to first have the bills already within the escrow regions 116a-116f to be delivered to the respective lower storage cassettes 106c-106h so that those bills may be included in the aggregate value data for the bills being processed. The bills remaining in the transport path 104 would then be delivered to a predetermined escrow region 116 where those bills could be removed and reprocessed by placing those

10 bills in the input receptacle 102.

Utilizing flow control to detect jams is more desirable than prior art currency evaluation machines which do not detect a jam until a sensor is actually physically blocked. The latter method of jam detection permits bills to pile up while waiting for a sensor to become blocked. Bill pile-up is problematic because it may physically halt the

15 machine before the jam is detected and may cause physical damage to the bills and the machine. In order to remedy a jam in a prior art machine, the operator must first manually physically dislodge the jammed bills. The operator must then manually turn a hand crank which advances the transport path until all bills within the transport path are removed. Moreover, because the prior art devices permit multiple bills to pile up before a

20 jam is detected, the integrity of the process is often ruined. In such a case, the entire stack of bills must be reprocessed.

Referring back to FIG. 1a, the illustrated embodiment of the currency handling device 100 includes a total of six lower output receptacles 106c-106h. More specifically, each of the lower output receptacles 106c-106h includes a first portion designated as an

25 escrow compartment 116a-116f and a second portion designated as a storage cassette 118a-118f. Typically, bills are initially directed to the escrow compartments 116, and thereafter at specified times or upon the occurrence of specified events, which may be selected or programmed by an operator, bills are then fed to the storage cassettes 118. The storage cassettes are removable and replaceable, such that stacks of bills totaling a

30 predetermined number of bills or a predetermined monetary value may be accumulated in a given storage cassette 118, whereupon the cassette may be removed and replaced with an empty storage cassette. In the illustrated embodiment, the number of lower output

receptacles 106c-106h including escrow compartments 116 and storage cassettes 118 are six in number. In alternative embodiments, the currency handling device 100 may contain more or less than six lower output receptacles including escrow compartments and storage cassettes 118. In other alternative embodiments, modular lower output  
5 receptacles 106 can be implemented to add many more lower output receptacles to the currency handling system 100. Each modular unit may comprise two lower output receptacles. In other alternative embodiments, several modular units may be added at one time to the currency handling device 100.

A series of diverters 130a-130f, which are a part of the transportation mechanism  
10 104, direct the bills to one of the lower output receptacles 106c-106h. When the diverters 130 are in an upper position, the bills are directed to the adjacent lower output receptacle 106. When the diverters 130 are in a lower position, the bills proceed in the direction of the next diverter 130.

The vertical arrangement of the lower output receptacles 106c-106h is illustrated  
15 in FIG. 5. The escrow compartment 116 is positioned above the storage cassette 118. In addition to the escrow compartment 116 and the storage cassette 118, each of the lower output receptacles 106c-106h contains a plunger assembly 300. The plunger assembly 300 is shown during its decent towards the storage cassette 118.

Referring now to FIGS. 6 and 7, one of the escrow compartments 116 of the  
20 lower output receptacles 106c-106h is shown. The escrow compartment 116 contains a stacker wheel 202 to receive the bills 204 from the diverter 130. The stacker wheel 202 stacks the bills 204 within the escrow compartment walls 206, 208 on top of a gate 210 disposed between the escrow compartment 116 and the storage cassette 118. In an alternative embodiment, the escrow compartment 116 contains a pair of guides to aid in  
25 aligning the bills substantially directly on top of one another. The gate 210 is made up of two shutters: a first shutter 211 and a second shutter 212. The shutters 211, 212 are hingedly connected enabling the shutters 211, 212 to rotate downward approximately ninety degrees to move the gate from a first position (closed position) wherein the shutters 211, 212 are substantially co-planer to a second position (open position) wherein  
30 the shutters 211, 212 are substantially parallel. Below the gate 210 is the storage cassette 118 (not shown in FIGS. 6 and 7).

FIG. 8 illustrates the positioning of the paddle 302 when transferring a stack of bills from the escrow compartment 116 to the storage cassette 118. When the paddle descends upon the stack of bills 204 it causes shutters 211, 212 to quickly rotate in the directions referred to by arrows B and C, respectively; thus, "snapping" open the gate 210. The quick rotation of the shutters 211, 212 insures that the bills fall into the storage cassette 118 in a substantially stacked position. According to one embodiment, the paddle is programmed to descend after a predetermined number of bills 204 are stacked upon the gate 210. According to other embodiments, the operator can instruct the paddle 302 via the control unit 120 to descend upon the bills 204 stacked upon the gate 210.

Referring now to FIG. 9, the plunger assembly 300 for selectively transferring the bills 204 from an escrow compartment 116 to a corresponding storage cassette 118 and the gate 210 are illustrated in more detail. One such plunger assembly 300 is provided for each of the six lower output receptacles 106c-106h of the currency handling device 100. The plunger assembly 300 comprises a paddle 302, a base 304, and two side arms 306, 308. Each of the shutters 211, 212 comprising the gate 210 extend inwardly from corresponding parallel bars 214, 215. The bars 214, 215 are mounted for pivoting the shutters between the closed position and the open position. Levers 216, 217 are coupled to the parallel bars 214, 215, respectively, to control the rotation of the bars 214, 215 and hence of the shutters 211, 212. Extension springs 218, 219 (shown in FIG. 8) tend to maintain the position of the levers 216, 217 both in the closed and open positions. The shutters 211, 212 have an integral tongue 213a and groove 213b arrangement which prevents any bills which are stacked upon the gate 210 from slipping between the shutters 211, 212.

The base 304 travels along a vertical shaft 311 with which it is slidably engaged. The base 304 may include linear bearings (not shown) to facilitate its movement along the vertical shaft 311. The plunger assembly 300 may also include a vertical guiding member 312 (see FIG. 11) with which the base 304 is also slidably engaged. The vertical guiding member 312 maintains the alignment of the plunger assembly 300 by preventing the plunger assembly 300 from twisting laterally about the vertical shaft 311 when the paddle 302 forces the bills 204 stacked in the escrow area 116 down into a storage cassette 118.

Referring also to FIG. 10, the paddle 302 extends laterally from the base 304. The paddle 302 is secured to a support 314 extending from the base 304. A pair of side arms

306, 308 are hingedly connected to the base. Each of the side arms 306, 308 protrude from the sides of the base 304. Rollers 316, 318 are attached to the side arms 306, 308, respectively, and are free rolling. Springs 313a, 313b are attached to the side arms 306, 308, respectively, to bias the side arms 306, 308 outward from the base 304. In the  
5 illustrated embodiment, the spring 313a, 313b are compression springs.

The paddle 302 contains a first pair of slots 324 to allow the paddle to clear the stacker wheel 202 when descending into and ascending out of the cassette 118. The first pair of slots 324 also enables the paddle 302 to clear the first pair of retaining tabs 350 within the storage cassette (see FIG. 14). Similarly, paddle 302 contains a second pair of  
10 slots 326 to enable the paddle 302 to clear the second pair of retaining tabs 350 within the storage cassette 118 (see FIG. 14).

Referring now to FIG. 11, which illustrates a rear view of one of the lower output receptacles 106c-106h, the plunger 300 is bidirectionally driven by way of a belt 328 coupled to an electric motor 330. A clamp 332 engages the belt 328 into a channel 334 in  
15 the base 304 of the plunger assembly 300. In the embodiment illustrated in FIG. 11, two plunger assemblies 300 are driven by a single electric motor 330. In one embodiment of the currency handling device, the belt 328 is a timing belt. In other alternative embodiments, each plunger assembly 300 can be driven by a single electric motor 330. In still other alternative embodiments, there can be any combination of motors 330 to  
20 plunger assemblies 300.

FIGS. 12 and 13 illustrate the interaction between the side arms 306, 308 and the levers 216, 217 when the paddle assembly 300 is descending towards and ascending away from the storage cassette 118, respectively. Initially, before descending towards the cassette, the shutters are in a first (closed) position. In the illustrated embodiment, it is  
25 the force imparted by the paddle 302 which opens the gate 210 when the paddle descends towards the storage cassette 118. When the paddle is ascending away from the storage cassette 119, it is the rollers 316, 318 coupled to the side arms 306, 308 which engage the levers 216, 217 that close the gate 210. The levers 216, 217 shown in FIG. 12 are positioned in the open position. When descending towards the storage cassette 118, the  
30 rollers 316, 318 contact the levers 216, 217 and roll around the levers 216, 217 leaving the shutters in the open position. The side arms 306, 308 are hinged in a manner which allows the side arms 306, 308 to rotate inward towards the base 304 as the rollers 316,

318 engage the levers 216, 217. FIG. 13 illustrates the levers in the second position wherein the gate 210 is closed. When the paddle ascends out of the storage cassette, the side arms 306, 308 are biased away from the base 304. The rollers 316, 318 engage the levers 216, 217 causing the levers to rotate upward to the first position thus closing the gate.

FIGS. 14, 15, and 16 illustrate the components of the storage cassettes 118. The bills 204 are stored within the cassette housing 348 which has a base 349. Each storage cassette 118 contains two pairs of retaining tabs 350 positioned adjacent to the interior walls 351, 352 of the storage cassette. The lower surface 354 of each tab 350 is substantially planar. The tabs 350 are hingedly connected to the storage cassette 118 enabling the tabs 350 to downwardly rotate from a horizontal position, substantially perpendicular with the side interior walls 351, 352 of the cassette 118, to a vertical position, substantially parallel to the interior walls 351, 352 of the cassette 118. The tabs 350 are coupled to springs (not shown) to maintain the tabs in the horizontal position. The storage cassette 118 contains a slidable platform 356 which is biased upward. During operation of the currency handling system 100, the platform 356 receives stacks of bills from the escrow compartment 116. The floor 356 is attached to a base 358 which is slidably mounted to a vertical support member 360. The base 358 is spring-loaded so that it is biased upward and in turn biases the platform 356 upward. The storage cassettes 118 are designed to be interchangeable so that once full, a storage cassette can be easily removed from the currency handling device 100 and replaced with an empty storage cassette 118. In the illustrated embodiment, the storage cassette 118 is equipped with a handle 357 in order to expedite removal and/or replacement of the storage cassettes 118. Also in the illustrated embodiment, the storage cassette 118 has a door 359 which enables an operator to remove bills from the storage cassette 118.

The storage cassettes 118 are dimensioned to accommodate documents of varying sizes. In the illustrated embodiment, the storage cassettes 118 has a height,  $H_2$ , of approximately 15.38 inches (39 cm), a depth,  $D_2$ , of approximately 9 inches (22.9 cm), and a width,  $W_2$ , of approximately 5.66 inches (14.4 cm). The storage cassette illustrated in FIG. 15 has stand-offs 362 to set interior wall 352 off a fixed distance from the interior wall 353 of the cassette housing 348. The interior walls 351, 352 aid in aligning the bills in a stack within the storage cassettes. The embodiment of the storage cassette



illustrate in FIG. 15 is sized to accommodate United States currency documents. To properly accommodate United States currency documents, the interior width of the storage cassette,  $W_3$ , is approximately 2.88 inches. FIGS. 17a and 17b also illustrate an embodiment of the storage cassette 118 sized to accommodate U.S. currency documents which have a width of approximately 2.5 inches (approximately 6.5 cm) and a length of approximately 6 inches (approximately 15.5 cm). In alternative embodiments, the length of the stand-offs 362 can be varied to accommodate documents of varying sizes. For example, the embodiment disclosed in FIG. 18a and 18b has an interior width,  $W_3$  of approximately 4.12 inches (104.6 cm) and is sized to accommodate the largest international currency, the French 500 Franc note, which has width of approximately 3.82 inches (9.7 cm) and a length of approximately 7.17 inches (18.2 cm). In order to accommodate large documents and increase the interior width,  $W_3$ , of the storage cassette 118, the lengths of stand-offs 362, illustrated in FIG. 16b, are shortened.

Beginning with FIG. 7, the operation of one of the lower output receptacles 106c-106h will be described. Pursuant to a mode of operation, the bills 204 are directed by one of the diverters 130 into the escrow compartment 116 of the lower output receptacle. The stacker wheel 202 within escrow compartment 116 receives the bills 204 from the diverter 130. The stacker wheel 202 stacks the bills 204 on top of the gate 210. Pursuant to a preprogrammed mode of operation, once a predetermined number of bills 204 are stacked in the escrow compartment 116, the control unit 120 instructs the currency handling device 100 to suspend processing currency bills and the paddle 302 then descends from its home position above the escrow compartment 116 to transfer the bills 204 into the storage cassette 118. Once the bills 204 have been deposited in the storage cassette 118 the currency handling device resumes operation until an escrow compartment is full or all the bills within the input receptacle 102 have been processed.

Referring now to FIGS. 8 and 9 the plunger assembly 300 downwardly travels placing the paddle 302 onto of the stack of bills 204. Upon making contact with the bills 204 the paddle 302 continues to travel downward. As the paddle 302 continues its descent, the paddle 302 forces the gate 210 to snap open. The paddle 302 imparts a force to the bills 204 that is transferred to the to the shutters 211, 212 causing the shutters 211, 212 to rotate from the closed position to the open position. The rotation of the shutters 211, 212 is indicated by the arrows B and C, respectively. Once the paddle 302 imparts

the amount of force necessary to rotate levers 216, 217, the extension springs 218, 219 quickly rotate the shutters 211, 212 downward, thus “snapping” the gate 210 open. The downward rotation of the shutters 211, 212 causes each of the corresponding parallel bars 214, 215 to pivot which in turn rotates the levers 216, 217. The extension springs 218, 219 maintain the shutters 211, 212 in the open position allowing the paddle 302 to descend into the storage cassette 118. The hingedly connected side arms 306, 308 retract as the rollers 316, 318 to roll around the levers 216, 217 while the plunger assembly 300 is traveling downward into the cassette 118.

Referring now to FIG. 15, once the gate 210 is opened, the bills 204 fall a short distance onto the platform 356 of the storage cassette 118 or onto a stack of bills 204 already deposited on the platform 356. The paddle 302 continues its downward motion towards the storage cassette 118 to ensure that the bills 204 are transferred to the cassette 118. Initially, some bills 204 may be spaced apart from the platform 356 or the other bills 204 within the storage cassette by retaining tabs 350. As the plunger assembly 300 continues to descend downward into the cassette, the paddle 302 continues to urge the stack of bills 204 downward causing the retaining tabs 350 to rotate downward. The bills 204 are pushed past retaining tabs 350 and onto the platform 356.

Once the plunger assembly 300 has descended into the cassette 118 a distance sufficient for the paddle 302 to clear the retaining tabs 350 allowing the retaining tabs 350 to rotate upward, the plunger assembly initiates its ascent out of the storage cassette 118. The platform 356 urges the bills 204 upward against the underside of the paddle 302. The paddle 302 is equipped with two pairs of slots 324, 326 (FIG. 9) to enable the paddle to clear the pairs of retaining tabs 350. When the paddle 302 ascends past the pairs of retaining tabs 350 the bills 204 are pressed against the lower surfaces 354 of the pairs of retaining tabs 350 by the platform 356.

Referring now to FIG. 13, when the plunger assembly 300 is traveling upward out of the cassette 118, the rollers 316, 318 on the side arms 306, 308 engage the respective levers 216, 217 and move the respective levers 216, 217 from the second (open) position to the first (closed) position to move the gate 210 from the open position to the closed position as the paddle 302 ascends into the escrow compartment 116 after depositing the bills 204 in the storage cassette 118. The paddle 302 is mounted on the base 304 above

the rollers 316, 318 on the side arms 306, 308 so that the paddle 302 clears the gate 210 before the gate 210 is moved to the closed position.

In alternative embodiments of the currency handling device 100, the output receptacles 106 can be sized to accommodate documents of varying sizes such as various international currencies, stock certificates, postage stamps, store coupons, *etc.* Specifically, to accommodate documents of different widths, the width of the escrow compartment 116, the gate 210, and the storage cassette 118 would need to be increased or decreased as appropriate. The document evaluation device 100 is sized to accommodate storage cassettes 118 and gates 210 of different widths. The entire transport mechanism 104 of the currency handling device 100 is dimensioned to accommodate the largest currency bills internationally. Accordingly, the document handling device 100 can be used to process the currency or documents of varying sizes.

In various alternative embodiments, the currency handling device 100 is dimensioned to process a stack of different sized currencies at the same time. For example, one application may require the processing of United States dollars (2.5 inches x 6 inches, 6.5 cm x 15.5 cm) and French currency (as large as 7.17 inches x 3.82 inches, 18.2 cm x 9.7 cm). The application may simply require the segregation of the U.S. currency from the French currency wherein the currency handling device 100 delivers U.S. currency to the first lower output receptacle 106c and the French currency to the second output receptacle 106d. In another alternative embodiment, the currency handling device 100 processes a mixed stack of U.S. ten and twenty dollar bills and French one hundred and two hundred Franc notes wherein the currency documents are denominated, counted, and authenticated. In that alternative embodiment, the U.S. ten and twenty dollar bills are delivered to the first 106c and second 106d lower output receptacles, respectively, and the French one hundred and two hundred Franc notes are delivered to the third 106e and fourth 106f lower output receptacle, respectively. In other alternative embodiments, the currency handling device 100 denominates, counts, and authenticates six different types of currency wherein, for example, Canadian currency is delivered to the first lower output receptacle 106c, United States currency is delivered to the second output receptacle 106d, Japanese currency is delivered to the third lower output receptacle 106e, British currency is delivered to the fourth lower output receptacle 106f, French currency is delivered to the fifth lower output receptacle 106g, and German

currency is delivered to the sixth lower output receptacle 106h. In another embodiment, no call bills or other denominations of currency, such as Mexican currency for example, may be directed to the second upper output receptacle 106b. In another embodiment, suspect bills are delivered to the first upper output receptacle 106a.

- 5 In other alternative embodiments of the currency handling device 100, the user can vary the type of documents delivered to the output receptacles 106. For example, in one alternative embodiment an operator can direct, via the control unit 120, that a stack of one, five, ten, twenty, fifty, and one-hundred United States dollar bills be denominated, counted, authenticated, and directed into lower output receptacles 106c-106h,  
10 respectively. In still another alternative embodiment, the currency handling device 100 is also instructed to deliver other bills, such as a United States two dollar bill or currency documents from other countries that have been mixed into the stack of bills, to the second upper output receptacle 106b. In still another alternative embodiment, the currency handling device 100 is also instructed to count the number and aggregate value of all the  
15 currency bills processed and the number and aggregate value of each individual denomination of currency bills processed. These values can be communicated to the user via the display/user-interface 122 of the currency handling device 100. In still another alternative embodiment, no call bills and bills that are stacked upon one another are directed to the second upper output receptacle 106b. In still another alternative  
20 embodiment, the operator can direct that all documents failing an authentication test be delivered to the first upper output receptacle 106a. In another alternative embodiment, the operator instructs the currency handling device 100 to deliver no call bills, suspect bills, stacked bills, *etc.* to one of the lower output receptacles 106c-106h. The currency handling device 100 which has eight output receptacles 106a-106h provides a great deal  
25 of flexibility to the user. And in other alternative embodiments of the currency handling device 100, numerous different combinations for processing documents are available.

- According to one embodiment, the various operations of the currency handling device 100 are controlled by processors disposed on a number of printed circuit boards ("PCBs") such as ten PCBs located throughout the device 100. In one embodiment of the  
30 present invention, the processors are Motorola processors, model number 86HC16, manufactured by Motorola, Inc. of Schaumburg, Illinois. Each of the processors are linked to a central controller via a general purpose communications controller disposed on

each PCB. In one embodiment of the present invention the communications controller is an ARCNET communications controller, model COM20020, manufactured by Standard Microsystems Corporation of Hauppauge, New York. The communications controller enables the central controller to quickly and efficiently communicate with the various

5 components linked to the PCBs.

According to one embodiment, two PCBs, a "motor board" and a "sensor board," are associated with each pair of lower output receptacles 106c-106h. The first two lower output receptacles 106c, d, the second two lower output receptacles 106e, f, and the last two lower output receptacles 106g, h are paired together. Each of the lower output  
10 receptacles 106 contain sensors which track the movement of the bills into the lower output receptacles 106c-106h, detect whether each storage cassette 118a-118e is positioned within the currency handling device 100, detect whether the doors 359 of the storage cassettes 118 are opened or closed, and whether the cassettes 118 are full. These  
15 aforementioned sensors associated with each pair of the lower output receptacles are tied into a sensor board which is linked to the central controller. The operation of the plunger assembly 300, the stacker wheels 202, the portion of transportation mechanism 104 disposed above the lower output receptacles 116c-116h, and the diverters 130 are controlled by processors disposed on the motor board associated with each pair of lower  
20 output receptacle's 106c-106h. Those sensors 130 which track the movement of bills along the transportation mechanism 104 that are disposed directly above the lower output receptacles 106c-106h are also tied into the respective motor boards.

One of the four remaining PCBs is associated with the operation of the one or two stacker wheels 127 associated with the upper output receptacles 106a, b, the stripping  
25 wheels 140, the primary drive motor of the evaluation region 108, a diverter which direct bills to the two upper output receptacles 106a, b, and the diverter which then directs bills between the two upper output receptacles 106a, b. The remaining three PCBs are associated with the operation of the transport mechanism 104 and a diverter which directs bills from the transport path to the bill facing mechanism 110. The plurality of sensors 130 disposed along the transport mechanism 104, used to track the movement of bills  
30 along the transport mechanism 104, also tied into these three remaining PCBs.

Referring now to FIGS. 19-22, a two belt bill facing mechanism 400 is illustrated. The two belt bill facing mechanism 400 is an alternative embodiment of the bill facing

mechanism 110 referred to in FIGS. 1a and 1b and in the above related discussion. The two belt bill facing mechanism 400 can be used in conjunction with the currency handling device 100 shown in FIGS. 1a and 1b to rotate the face orientation of a bill 401 approximately 180°. For example, if a U.S. bill, for example, is initially presented with the surface bearing a portrait of a president facing down, it may be directed to the two belt bill facing mechanism 400, whereupon it will be rotated 180° so that the bill surface with the portrait faces up. The decision may be taken to send a bill 401 to the facing mechanism 400 when the selected mode of operation or other operator instructions call for maintaining a given face orientation of bills as they are processed by the currency handling device 100. For example, it may be desirable in certain circumstances for all of the bills ultimately delivered to the lower output receptacles 106c-106h to have the same face orientation. In such embodiments of the currency handling device 100, the bill evaluation region 108 is capable of determining the face orientation of a bill, such that a bill not having the desired face orientation can first be directed to the two belt bill facing mechanism 400 before being delivered to the appropriate lower output receptacle 106c-106h.

The two belt bill facing mechanism 400 ("facing mechanism") includes a first belt 402 and a second belt 404. Each of the first and the second belts 402,404 forms a continuous loop. The belts 402,404 are disposed adjacent to each other such that the opposing surfaces of each belt 402,404 forms a bill facing transport path 406. The belts 402, 404 are twisted together so that an inlet 408 of the transport path 406 is rotated approximately 180° with respect to an outlet 410 of the transport path 406.

The first and second belts 402, 404 are each wrapped around two rollers. The first belt 402 is positioned around a first roller 412 disposed adjacent the inlet 408 and a second roller 414 disposed adjacent the outlet 410. The second belt 404 is positioned around a third roller 416 disposed adjacent the inlet 408 and a fourth roller 418 disposed adjacent the outlet 410. As illustrated in FIG. 19, the first and second rollers 412,414, associated with the first belt, are positioned such that the first roller 412 is the "top" roller at the inlet 408 and the second roller 414 is the "bottom" roller at the outlet 410. The third and forth rollers 416,418, associated with the second belt, are positioned such that the third roller 416 is the "bottom" roller at the inlet 408 and the forth roller 418 is the "top" roller at the outlet 410. This arrangement allows the for the "twisted" bill facing

mechanism transport path 406. Starting from the inlet 408, a first end 402a of the first belt 402 is placed around the first roller 412 which is disposed above the third roller 416 around which a first end 404a of the second belt 404 is placed. Viewing FIG. 19 from right to left, the first and the second belts 402,404 are together twisted 180° out of the page. The second end 404b of the second belt 404 is now disposed above the second end 402b of the first belt 402. The second end 404b of the second belt 404 is positioned around the forth roller 418 and the second end 402b of the first belt 402 is positioned around the third roller 414. Between the inlet 408 and the outlet 410, that is between the rollers, there is no structure supporting the portions of the first or the second belts 402,404 which define the bill transport path 406. The rollers are connected to shafts 419 about which the rollers rotates. In one embodiment of the two belt bill facing mechanism, the rollers 414,418 are driven rollers and the rollers 412,416 are passive rollers. In such an embodiment, a motor (not shown) is coupled to the shafts 419 associated with driven rollers 414,418.

Two belt guides 420 (FIGS. 19 and 20) are used to guide the portion of the belts not defining the transport path 406 or the return portion 422 of the belts away from the transport path. The return portion 422 of the belts 402,404 is drawn away from the transport path 406 to insure that the return portion 422 does not contact a bill 401 traveling along the transport path 406 causing the bill 401 to become skewed relative to the transport path 406. Each belt guide 420 is attached to a structure 424 which is fixed to the currency handling device 100. In FIGS. 19 and 20, only the first belt guide 420 is clearly illustrated. In the illustrated embodiment, each belt guide 420 includes one vertical roller and two horizontal rollers 426. The vertical roller associated with the second belt guide 420 is labeled with reference number 427. The interior of each belt 402,404 travels against the vertical roller. Any vertical movement of the return portion 422 of the belt is constrained by the two horizontal rollers 426 along which the edges 428,429 of the belts 402,404 travel. In an alternative embodiment, the belt guide 420 only contains one horizontal roller 426 to limit the vertical movement of the return portions of the belts.

In the embodiment illustrated in FIG. 20, the two belt bill facing mechanism contains belt end guides 440. The belt end guides 440 are used to maintain the position of belts 402,404 on rollers 412, 416. The belt guides limit any horizontal movement of the belts 402, 404 at their first ends 402a, 404b. In another embodiment of the two, belt bill

facing mechanism two more belt end guides are used to limit any horizontal of the belts 402,404 at the second ends 402b, 404b. The belt end guides 440 consists of a structure 442 and two rollers 444. Because the belt guides 420 pull the return portion 422 away from the transport path 406, the belt guide rollers 444 maintain the belt ends on the rollers 412, 414, 416, 418 and prohibit any movement of the belts 402,404 off of the rollers 412, 414, 416, 418.

The bill facing mechanism 400 also contains four guides 431,432,433, 434 disposed along the bill transport path 406. Each of these guides are also fixed to the structures 424. The guides 431-434 are made out of a rigid material. A bill is transported through the bill facing mechanism (as well as the through the transport mechanism 104 of currency handling device 100) with the leading edge of the bill being the long or wide edge of the bill 401. The width of the bill 401 is greater than the width of the first and the second belts 402,404 causing a significant portion of the bill 401 to overhang each edge of the belts 402,404. The function of the guides is to provide support to those portions of the bill 401 which overhang the belts 402,404. Because of the high processing rate at which the currency handling device 100 operates, a significant angular velocity is imparted to a bill directed through the facing mechanism. In alternative embodiments of the currency handling device 100, bills are processed at speeds in excess of 1200 bills per minute. The differences in air pressures acting on the front and the back surfaces areas of the bill 401 can cause the bill 401 to fold or be forced such that the bill is no longer being transported in a substantially flat manner. This situation can occur more readily when the bill stiffness is degraded due to bill wear resulting from heavy usage. Additionally, bills are often folded in a variety of manners which may cause a bill to be biased in a certain direction such that the bill will not lie flat under its own weight. It is preferable for the bill 401 to be transported through the bill facing mechanism 400 (and the currency handling device 100) in a substantially flat manner. If the bill 401 is not substantially flat when traveling from the outlet 410 of the bill facing mechanism 400 back into the bill transport mechanism 104 there is a possibility that the bill may become skewed at the interface between the outlet 410 and the transport mechanism 104 because the transport mechanism 104 may not "catch" the entire leading edge of the bill.

In operation, a bill 401, shown in position E, enters the inlet 408 of the bill facing mechanism 400 and is transported along the bill facing transport path 406 in a direction



from right to left indicated by arrow D. The bill 401 adjacent to the outlet 410 is shown in position F which is a 180° rotation from position E. Referring to the bill 401 in position E, the bill 401 has narrow edges 450,451 and surfaces 452, 453. The first and second belts 402,404, a portion of which define the transport path 406, are twisted causing the bill 401 to rotate in manner such that the (near) edge 450 of the bill 401 drops into the page and the (far) edge 451 of the bill 401 rotates up and out of the page. As the bill 401 travels through the bill transport path 406, the surface 452 towards the (near) edge 450 of the bill 401 is guided by the first guide 431. The surface 453 towards the (far) edge 451 of the bill 401 is supported by the second guide 432. The guides 431,432 support their respective surfaces of the bill 401 until the bill 401 is substantially in a vertical position. As the bill continues to travel towards the outlet 410 the edge 451 (now at the top of the page) continues to rotate out of the page while the edge 450 (now at the bottom of the page) rotates into the page. Continuing, the surface 453 towards the edge 451 is being guided by the guide 433. The surface 452 towards edge 450 is being guided by the guide 434. When the bill arrives at the outlet 410, the orientation of the bill has been rotated 180°. The bill then merges into the transport mechanism 104 of the currency handling device 104.

In another alternative embodiment, the currency handling device 100 operates in a strapping mode wherein pursuant to a user's input or selection of a preprogrammed mode of operation, currency bills are stacked in a manner so that smaller stacks of bills within a larger stack of bills are readily identifiable. Typically, in the handling of bulk currency, after the currency bills have been analyzed, denominated, authenticated, counted, and/or otherwise processed, the currency bills are strapped. Bill strapping is a process whereby a stack of a specific number of bills of a single denomination are secured together such as with a paper strap. For example, one dollar bills are segregated into stacks of one-hundred one dollar bills and then bound with a paper strap. Strapping facilitates the handling of bulk currency allowing the strapped stacks of bills to be counted rather than the individual currency bills.

When operating pursuant to a strapping mode, the currency handling device 100 stacks currency bills in the lower output receptacles 106c-106h in a manner so that smaller batches of currency bills are readily identifiable such as by alternating the face orientation of the smaller batches of bills within the stack. Put another way, as illustrated

- in FIG. 23, every other smaller stack 550 of bills comprising the larger stack 552 of bills is either orientated with the surface of the bill bearing the portrait of the president face-up or face-down. This arrangement allows a user of the currency handling device 100 to quickly segregate the smaller stacks 550 from the larger stack 552 of bills for strapping
- 5 purposes after the user removes the larger stack 552 of bills from the storage cassette 118a-f associated with a corresponding lower output receptacle 106c-h. For example, a user desiring to "strap" U.S. \$20 bills would instruct the currency handling device accordingly, so that the face-orientation of every batch of one-hundred \$20 bills would alternate.
- 10 A bill turnover mechanism, such as for example, either the two belt bill facing mechanism 400, illustrated in FIGS. 19-22, or the bill facing mechanism 110, referred to in FIGS. 1a and 1b, can be incorporated into the currency handling device 100 to vary the face orientation of the bills pursuant to a strapping mode so that the individual currency bills within each smaller stack 550 of currency bills has a common face orientation.
- 15 Alternatively, in other embodiments of the present invention, other turnover mechanisms can be used.

The total number of bills per smaller stack 550 of currency bills is referred to as a "limit." The "limit" is a predetermined number which is either defined by the user of the currency handling system 100 or is defined by a mode of operation. In one embodiment,

20 the user defines via the user interface 122 that the limit is, for example, fifty currency bills. Accordingly, the face orientation of every fifty currency bills is alternated. In another alternative embodiment, a user selects via the user interface 122 a "\$20 strapping mode" wherein, for example, the limit is predefined at one hundred \$20 bills. While any number of bills can be included in a strap of currency bills, U.S. currency bills are traditionally

25 strapped in one-hundred bill stacks.

Referring also to FIG. 24, the steps performed in a strapping mode of operation will be described in detail. For purposes of this example, the stack of bills consists of U.S. \$20 bills arranged in both face orientations. Initially at steps 502, 504, and 506, the limit is defined, the bill count is set to zero, and the target orientation is defined, respectively.

30 The target face orientation is the face orientation in which the first smaller stack of bills are to have when stacked in a particular output receptacle 106c-106h such as output receptacle 106f. The target orientation, either face-up or face-down, can be

predetermined pursuant to a mode of operation or be input by a user at step 506. In an alternative embodiment of the currency handling device 100, the target orientation can be defined as the orientation of the first currency bill transported through the evaluation region 108 or the first currency bill of a given denomination transported through the evaluation region 108. The initial target orientation dictates the orientation of the first smaller currency bill stack 550 stacked on the platform 356 of a particular storage cassette 118a-f. Accordingly, the initial target orientation of the strapping mode which resulted in the stack of currency bills illustrated in FIG. 23 was face-up.

Upon the commencement of the operation of the currency handling device 100, the bills are transported one at a time through the evaluation region 108 to one of the output receptacles 106c-h. At step 508, while being transported through the evaluation region 108, the face orientation of each of the bills is determined. The face orientation of the bill currently being evaluated is compared to the target orientation at 510. If the orientation of the currency bill currently being evaluated matches the target orientation, the face orientation of the bill is maintained at step 512 and the bill is transported to a particular one of the output receptacles 106c-h at step 514. If the orientation of the currency bill currently being evaluated fails to match the target orientation, the bill is first transported to the bill facing mechanism 400 at step 516, where the face orientation of the bill is reversed as the bill is rotated 180°. The properly faced bill is then transported to and stacked in a particular one of the output receptacles 106c-h at step 514. As each bill is transported to the output receptacle 106c-106h, at step 516, a bill counter increases by one until the number of bills transported to the particular output receptacle 106c-h having a common face orientation is equivalent to the strap limit. The strap limit is compared to the bill count at step 518. When the bill count is equivalent to the strap limit, the target face orientation is redefined to be the other of the two face orientations – face-up or face-down – at step 520. The bill count is then reset to zero at step 522. The currency evaluation device continues to operate in this manner until the entire batch of currency bills is processed.

The foregoing is one example of the steps performed in processing currency bills with the currency handling device 100 pursuant to a stacking mode of operation. In alternative embodiments, the sequence in which the steps are performed can be rearranged in a variety of other orders or combined. For example, in an alternative embodiment, the

steps Define The Limit 502, Set Bill Count To Zero 504, and Define The Target Orientation 506 can be combined in a preprogrammed strapping mode of operation which the user simply selects from the user interface 122. For example, a "\$50 strapping" mode of operation may be selected by the user, via the user interface 122, wherein the limit is predefined at one-hundred bills, the bill count is set to zero, and the initial target orientation is defined as face-down.

In alternative embodiments of the present invention, the currency bills can be processed into the lower output receptacles 106c-h in a variety of manners. For example, in one embodiment, bills are processed into the escrow region 116 until the escrow region 116 is full. At that time, the plunger assembly 300 transfers the bills from the escrow region 116 to the corresponding storage cassette 118. The currency handling device 100 operates in this manner until all of the bills have been processed into the storage cassette(s) 118. If, after all of the bills have been processed, a smaller stack of bills has been delivered to a storage cassette 118 containing a number of bills which is less than the strap limit, the currency handling device 100 can notify the user via the user interface 122. In still another alternative embodiment, after a number of bills equivalent to the strap limit are processed into the escrow region 116, the plunger assembly 300 transfers the bills to the storage cassette 300. In this embodiment of a strapping mode of operation, all of the smaller stacks of bills in the storage cassette comprise a number of bills equivalent to the strap limit. A stack of bill comprising a number of currency bill less then the limit remains in the escrow region until either the stack is removed by the operator of the currency handling device 100 or until the stack is supplemented with bills from an additional batch of currency processed by the currency handling device.

After the entire batch of currency bills is processed into the lower output receptacles 106c-h pursuant to a strapping mode of operation, a user of the currency handling device 100 removes the stacks of bills from each storage cassette 118a-f associated with corresponding lower output receptacles 106c-h. Because the smaller stacks of bills within each of the larger stacks of bills removed from the storage cassettes 118a-f are arranged with alternating face orientations, the user can quickly segregate the smaller stacks from the larger stacks and bind each of the smaller stacks with a strap.

In an alternative embodiment of the present invention, larger stacks of bills comprising smaller stacks of bills having alternative face orientations, such as illustrated in

FIG. 23, can be formed in the lower output receptacles 106c-h without using the bill facing mechanism. In such an embodiment, face-up bills are transported to a "target" lower output receptacle and face-down bills are transported to another target lower output receptacle until the limit is reached in both lower output receptacles. The target

5 receptacles 106 are then switched and the process is repeated. For example, bills of a given denomination having a face-up orientation are routed to the first lower output receptacle 106c and bills of the same denomination having a face-down orientation are routed to the second lower output receptacle 106d. Face-up and face-down bills continue to be processed into the first and second lower output receptacles 106c, d, respectively,

10 until a number of bills equivalent to the limit have been processed into the first and second lower output receptacles 106c, d. At that time, the face-up bills are then routed to the second lower output receptacle 106d and the face-down bills are routed to the first lower output receptacle 106c. Bills continue to be processed in this manner until the limit is again reached in both the first and second lower output receptacles 106c, d at which time

15 the target lower output receptacles 106 of the face-up and face-down bills are again switched. The process continues as described until the entire batch of currency is processed and each of the lower output receptacles 106c, d contain larger stacks of bills comprising smaller stacks having alternating face orientations. Obviously, the limit will be reached in one of the two lower output receptacles 106c, d before the other of the two

20 lower output receptacles 106c, d. Accordingly, the excess bills are off-sorted or, alternatively, a similar method is performed in the adjacent lower output receptacles 106e, f. For example, when the limit is first reached with respect to face-up bills directed to the first lower output receptacle 106c, those face-up bills are then routed to the third lower output receptacle 106e while face-down bills continue to be directed to the second lower

25 output receptacles 106d. Should the limit be reached in the third lower output receptacle 106e before the second lower output receptacle 106d, the face-up bills can then be directed to the next lower output receptacle 106f. When the limit in the second output receptacle 106d is eventually reached, the target lower output receptacles 106c, d of the face-up and face-down bills can be switched as described. While the above example was

30 discussed in conjunction with the processing of only one denomination of currency bills, in other alternative embodiments more than one denomination of currency bills can be processed in a similar manner.

In still other alternative embodiments of the present invention, smaller stacks of bills can be distinguished, for strapping purposes, from larger stacks of bills processed into lower output receptacles in a variety of other manners without alternating the face orientation of consecutive smaller stacks of bills. In one alternative embodiment, dividers  
5 such as sheets of paper are injected into the flow of currency bills so that the sheets of paper are disposed between each of the smaller stacks of currency bills. These "separation sheets" may be any one of a variety of colors that are readily distinguishable from the currency bills being processed such as, for example, fluorescent orange, pink, yellow, red, *etc.* Sheets which are readily distinguishable from the currency bills being  
10 processed will facilitate the user's identification and segregation of the smaller stacks of currency bills within the larger stack. In other embodiments, a marking on the "separation sheets" denoting the quantity of bills, the denomination of the bills, and/or the value of each smaller stack of bills may provide information to the user of the currency handling device 100.

15 In still another alternative embodiment, rather than reversing the face orientation of the bills to distinguish the smaller stacks of currency bills, each of the smaller stacks 554 are slightly offset from the previous smaller stack as illustrated in FIG. 25a. In such an embodiment, each consecutive smaller stack 554 of bills comprising the larger 556 stack may be offset so that the larger stack 556 of bills appear "stepped" in shape.  
20 Alternatively, as illustrated in FIG. 25b, each smaller stack of bills 558 are off-set to the left and to the right of a center C of the platform 356 of the storage cassette 118 in which the bills are stacked so that the side of the larger stack of bills 560 appear corrugated in shape.

Many of the aforementioned modes of operation can be combined with a strapping  
25 mode in a multitude of alternative embodiments of the present invention. For example, in an alternative embodiment of the present invention, several denominations of U.S. currency bills may be processed pursuant to a strapping mode of operation. In such an embodiment U.S. \$1, \$5, \$10, \$20, \$50, and \$100 bills are processed pursuant to a strapping mode of operation into the lower output receptacles 106c-106h, respectively –  
30 while alternating the face orientation of every set of one-hundred bills within each of the output receptacles. Accordingly, in such an embodiment, the currency handling device must denominate each of the currency bills being processed. Continuing with the current

example, when a non-U.S. \$1, \$5, \$10, \$20, \$50, or \$100 bill is detected, such as a Canadian \$1 bill or a U.S. \$2 bill, that bill is off sorted to one of the upper output receptacles 106a, b. Further, the currency handling device 100 can also authenticate each of the currency bills being processing pursuant to a strapping mode of operation. Non-authentic bills can be routed to upper output receptacles 106a, b as well. Alternatively, non-authentic bills can be routed to upper output receptacle 106a and non-U.S. \$1, \$5, \$10, \$20, \$50, or \$100 bills or no call bills are routed to upper output receptacles 106b.

In other alternative embodiments, the currency handling device 100 is capable of denominating, authenticating, and facing for strapping purposes batches of bills containing several different international currencies. For example, in one embodiment of the present invention, a user may desire to segregate, denominate, authenticate, and stack for strapping purposes U.S. \$20, \$50, \$100 bills and Canadian \$20, \$50, \$100 bills. The U.S. \$20, \$50, \$100 dollar bills may be directed to the first three lower output receptacles 106c-e and the Canadian \$20, \$50, \$100 bills may be directed to the second three lower output receptacles 106f-h. Accordingly, the currency handling device must denominate each of the currency bills before directing the bills to a lower output receptacle 106c-h. Non-U.S. \$20, \$50, \$100 bills and non-Canadian \$20, \$50, \$100 are directed to one of the upper output receptacles 106a, b such as the second upper output receptacle 106b. The bills may also be authenticated. Authentic U.S. \$20, \$50, \$100 bills and Canadian \$20, \$50, \$100 are directed to the appropriate lower output receptacles 106c-h. Those bills which are not authenticated, suspect bills, can be routed to the first upper output receptacle 106a. Further, non-U.S. \$20, \$50, \$100 suspect bills and non-Canadian \$20, \$50, \$100 suspect bills can also be directed to the first upper output receptacle 106a.

Additionally, in other alternative embodiments of the present invention, modular output receptacles can be added so that, for example, U.S. \$5 and \$10 bills are processed in the same manner along side the U.S. \$20, \$50, \$100 bills and Canadian \$20, \$50, \$100 bills.

As is apparent from the foregoing discussion, a strapping mode of operation can be combined with other modes of operation to instruct the currency handling device to operate in a multitude of different variations.

As discussed above, the currency handling system utilizes flow control to track the movement of each individual bill through the currency handling device 100 as well as to detect the occurrence of bill jams within the currency handling device 100. Utilizing flow

control not only allows the device 100 to more quickly detect bill jams, but also enables the device 100 to implement a bill jam reconciliation procedure which results in a significant time savings over the prior art. During normal operation, a processor in conjunction with the plurality of sensors 119 disposed along the transport mechanism 104

5 tracks each of the currency bills transported through the currency handling device 100 from the evaluation region 108 to the escrow regions 116. Accordingly, the processor monitors the number of bills that have, for example, advanced from the input receptacle 102 through the evaluation unit 108, the number of bills stacked in each of the escrow regions 116a-f, and the number of bills moved into the storage cassettes 118a-f. The

10 device 100 maintains separate counts of the number of bills delivered into each escrow region 116 and each of the storage cassettes 118. As bills are moved from an escrow region 116 to a corresponding storage cassette 118 the total number of bills being moved is added to the total number of bills in the storage cassette 118.

Upon the detection of a bill jam occurring in the transport mechanism 104, the

15 processor has maintained an accurate count of the number of bills which have already been transported into each escrow region 116. The integrity of the bill count is maintained because the flow control routine rapidly determines the presence of a bill jam within the transport mechanism 104. Again, as discussed above, if a bill does not pass the next sensor 119 within a predetermined number of encoder counts, the operation of the

20 transportation mechanism 104 is suspended and the user is alerted of the error. Because the transporting of bills is suspended almost immediately upon failure of a bill to pass a sensor 119 within a specific timeframe (e.g. number of encoder counts) thus preventing the pile-up of bills, the processor "knows" the specific location of each of the bills within the device 100 because the operation of the device is suspended before bills are allowed

25 to pile up.

Because of the almost immediate suspension of the transporting of bills, the integrity of the counts of the bills in the escrow regions 116 and the storage cassettes 118 are maintained. Before the system is flushed, the bills within each of the escrow regions 116 are downwardly transported from the escrow regions 116 to the corresponding

30 storage cassettes 118. If the bill jam occurs in one of the escrow regions 116, bills located in other escrow regions 116 where the bill jam has not occurred are transported to the respective storage cassettes 118.



In one embodiment of the currency evaluation device 10, the user is notified via the user interface 122 of the occurrence of a bill jam and the suspension of the transporting of bills. The user is prompted as to whether the bills in the escrow regions 116 should be moved to the storage cassettes 118. In other embodiments of the currency handling device, those bills already in the escrow regions are automatically moved to the storage cassettes upon detection of a bill jam. The user is directed, via the user interface 122, to the proximate location of the bill jam in the transport mechanism 104. If necessary, the user can electronically jog the transport mechanism 104, as described above, to facilitate the manual removal of the bill jam. After clearing the bill jam and causing those bill already transported into the escrow regions 116 to be moved into the corresponding storage cassettes 118, the user is prompted to flush the bills currently within the transport mechanism 104. Flushing the bills causes those bills still remaining in the transport mechanism 104 to be transported to one of the escrow regions 116. After the remaining bills are flushed from the transport mechanism 116, the operator can remove the flushed bills from the escrow region 116 for reprocessing.

Referring now to FIG. 26, the operation of the bill jam reconciliation process will be described in connection with the illustrated functional block diagram of the currency handling device 100. Pursuant to the user's selected mode of operation, currency bills are transported from the input receptacle 102 through the evaluation region 108 to one of the plurality of output receptacles 106a-h. According to some modes of operation, some of the currency bills all also transported through the bill facing mechanism 110 in those embodiments of the currency handling device 100 which implementing a bill facing mechanism 110. As each of the bills are transported thorough the currency handling device 100 by the transport mechanism 104, a processor, in connection with the plurality of bill passage sensors 119, tracks the movement of each of the bills from the evaluation region 106 to each of the escrow regions 116a-f pursuant to the flow control process discussed above. As bills are delivered into each of the escrow regions 116a-f, a escrow region bill counter 203 ("ER Count" in FIG. 26) assigned to each escrow region 116 maintains a count of the number of bills transported into each escrow region 116. After a predetermined number of bills have been transported into an escrow region 116, the operation of the transport mechanism is temporarily suspended while the bills are moved from the escrow region 116 to the corresponding storage cassette 118. A storage

cassette counter 205 ("SC Count" in FIG. 26) corresponding to each storage cassette 118, maintains a count of the total number of bills moved into a storage cassette. Upon moving bills from the escrow region 116 to the corresponding storage cassette 118, the escrow region count is added to the storage cassette count. After the adding the escrow  
5 region count and the storage cassette count, the escrow region counter 203 is reset to zero and the operation of the transport mechanism is resumed.

Upon detection of the occurrence of a bill jam, the operation of the transport mechanism 104 is suspended. At the time of the occurrence of a bill jam, each of the escrow regions have as many as two hundred fifty bills or as little as zero bill transported  
10 therein. A count of the specific number of bills in each of the escrow regions 116a-f is maintained by each of the escrow region counters 203a-f. In response to user input, the bills within the escrow regions 116 are moved from the escrow regions 116 to the storage cassettes 118 and the escrow bill count 203 is added to the storage cassette bill count 205. The operator of the currency handling device 100 can then clear the bill jam and  
15 flush the remaining bill from the transport mechanism 104 as discussed above. If the bill jam has occurred in one of the escrow regions 116, the bills in the remaining escrow regions 116 not having bill jams detected therein are moved to the corresponding storage cassettes 118. Those bill already transported into the escrow region 116 having the bill jam detected therein are reprocessed along with the bills flushed from the transport  
20 mechanism 104.

The ability of the currency handling device 100 to transport those bill already processed into the escrow regions 116 and into the storage cassettes 118 while maintaining the integrity of the bill counts 203, 205 with respect to each output receptacle 106c-h is a significant improvement resulting in appreciable time savings over prior art  
25 devices. In prior art devices, upon the occurrence of a bill jam, the operator would have to clear the bill jam and manually turn a hand crank to move the remaining bills from the transport path into the escrowing regions. Prior art devices do not maintain separate running totals as bills pass various points within the device. For example, a prior device may only count the bills as they are transported through an evaluation region of the  
30 currency handling machine. Bills exiting the evaluation region are included in the totals regardless of whether they are involved in bill jams or are successfully transported to an output receptacle. Therefore, when a bill jam occurs, those bills involved in the bill jam as

well as those bills already transported to the output receptacles have to be reprocessed. Other prior art devices having both holding areas and storage areas only maintain a count of the number of bill in the storage areas, but not a count of the number of bills in the holding areas.

5        Reprocessing all of the bills already transported into the holding areas is a time consuming process as the number of bills to be re-processed can be voluminous. In the present device for example, each of the escrow regions 116 can accommodate approximately 250 bills. Six escrow regions presents the possibility of having to reprocess up to 1500 bills upon the occurrence of a bill jam. The problem is further  
10        exasperated when modular lower output receptacles 106 are added. For example, the addition of eight modular lower output receptacles 106 brings the total number of lower output receptacles 106 to fourteen, thus up to 3500 bills would have to be reprocessed. The inefficiencies associated with this procedure arise from the loss of productivity while the device 100 is stopped and the time required to remove the stacks of bills from the  
15        escrow regions 116 as well as the time required to re-process the bills pulled from the escrow regions 116.

During the lifetime of prior art currency handling devices it is likely that individual key components of the devices, including components specific to the output receptacles, will degrade and eventually fail. The failure of an individual component specific to an  
20        output receptacle can render that output receptacle inoperable. The inoperability of one of the output receptacles of prior art currency handling devices can render the entire device inoperable regardless of whether the remaining output receptacles are otherwise properly functioning. Component failures resulting in the inoperability of the entire device can have a devastating effect on the cash handling operations of users of these devices.  
25        The inventors of the present invention have found that currency handling devices play a vital role in the overall operation of a cash vault, including cash vaults at banks or casinos. The inventors estimate that over 90% (ninety percent) of the cash handled within a cash vault is processed by a currency handling device. Therefore, the failure of a currency handling device can have a disastrous effect on the operation of a cash vault or other  
30        operations relying on the performance of the currency handling device.

Like prior art currency handling devices, it is anticipated that over the extended lifetime of the currency handling device 100 components of the device 100, including

components specific to the output receptacles 106, will degrade and eventually fail. Such individual components include, for example, the motor 330 (FIG. 11), the belt 328 (FIG. 11), sensors such as the bill passage sensors 119, solenoids, switches that indicate a cassette 118 is properly inserted into an output receptacle 106, and other electrical or mechanical components of the output receptacles 106. However, the currency processing device 100 of the present invention implements a backup routine to remedy the failure of a component(s) of an output receptacle 106 which would otherwise render the currency handling device 100 inoperable. The inventors of the present invention use the term “disable pockets” to describe this backup routine which essentially disables one or more output receptacles 106 (also called a “pocket”) in which component failure(s) have occurred.

Upon the failure of a component within one of the output receptacles, the user of the currency handling device 100 is informed of the error via the user interface 112. For example, each of the lower output receptacles 106c-h contains a switch (not shown) that is tripped when a cassette 118 is properly inserted into the output receptacle 106. Under normal circumstances, the control unit 120 detects the tripped switch upon proper insertion of a cassette 118 into the output receptacle 106 and the currency handling device 100 operates as intended. When a cassette 118 is improperly inserted, the control unit 120 does not detect the presence of a properly inserted cassette 118 and the user is prompted via the user interface 122. Upon a visual inspection or physical manipulation of the storage cassette 118, the operator can quickly determine whether the cassette 118 is properly inserted within the output receptacle 106. If the operator determines the cassette 118 is properly inserted and the error signal indicating otherwise is itself an error, the operator can implement the disable pockets routine via the user interface 122.

The implementation of the disable pockets routine will cause the control unit 120 to ignore the error conditions associated with the output receptacle 106 experiencing component failure by essentially shutting down that output receptacle, allowing the currency handling device 100 to operate with one less lower output receptacle 106c-h. For example, disabling the first lower output receptacle 106c will cause the currency handling device 100 to operate as though the device 100 has five lower output receptacles – the second lower output receptacle 106d through the sixth lower output receptacle 106h. Those bills normally directed to the first lower output receptacle 106c are now,

pursuant to the disable pockets routine, directed to another one of the output receptacles 106 such as the first or second upper output receptacles 106a-b. In other embodiments of the device 100, more than one lower output receptacle 106c-h may be disabled. For example, disabling the first two lower output receptacles 106c-d will cause the currency

5 handling device 100 to operate with four lower output receptacles – the third lower output receptacle 106e through the sixth lower output receptacle 106h.

According to one embodiment of the disable pockets routine, those bills which would normally be directed to the inoperable output receptacle(s) are now directed to the output receptacle to which bills triggering error conditions (e.g., no call bills) are directed

10 pursuant to various modes of operation. The disable pockets routine is designed to work with existing modes of operation (or other user-defined modes of operation) such as, for example, those modes of operation incorporated by reference above from PCT WO 99/09511, which is incorporated herein by reference in their entirety. Put another way, the disable pockets routine compliments the user-selected mode of operation by directing

15 bills otherwise directed to the disabled output receptacle to an alternative output receptacle.

In one embodiment of the disable pockets routine directs the bills otherwise directed to the disabled output receptacle to an output receptacle 106 to which bills triggering error conditions are directed pursuant to the current mode of operation of the

20 currency handling device 100. By way of example, one mode of operation may direct bills triggering a “no call” error condition to the second lower output receptacle 106b while directing U.S. \$1 bills to the first lower output receptacle 106c. Upon disabling the first lower output receptacle 106c, \$1 bills are automatically directed to the no call output receptacle 106b which is the second lower output receptacle. During operation of the

25 device 100, both no call bills and identifiable \$1 bills are directed to the second lower output receptacle 106b. The device 100 can suspend operation when a no call bill is delivered into the second upper output receptacle 106b giving the operator the opportunity to remove the no call bills from the identifiable \$1 bills. Alternatively, all bills triggering error conditions may be directed to the first upper output receptacle 106a and

30 \$1 bills are directed to the second lower output receptacle 106b. In other alternative embodiments, after one or more of the output receptacles 106 is disable, the user is prompted to select which of the remaining output receptacles 106 are to replace the

disabled output receptacle 106. The user may designate that U.S. \$1 bills be directed to the sixth lower output receptacle along with U.S. \$5 bills for example. Many of the modes of operation direct no call bills to one of the upper output receptacles 106a, b. However, in alternative embodiments of the present invention, bills triggering error conditions can be directed into any one of the plurality of output receptacles 106.

Referring now to FIG. 27, the operation of the currency handling device 100 pursuant to one embodiment of the disable pockets routine 600 will be described. Before implementing the disable pockets routine, the user of the currency handling device 100 determines that it is necessary to disable one or more of the output receptacles 106 of the device 100. Upon deciding to process a batch of currency bills, the user inputs or selects (via the user interface 122) a mode of operation at step 602. An illustrative screen 650 which may be displayed on the user interface 122 is illustrated in FIG. 29. The user can select one of a plurality of buttons 652 corresponding to the desired mode of operation. This step 602 may also include assigning denominations and strap limits to a specific mode of operation by selecting buttons 672 as shown in the illustrative screen 670 of FIG. 30. At step 604, the user instructs the device 100 to disable one of the output receptacles 106. This may include designating the specific output receptacle(s) 106 to be enabled and which output receptacle(s) 106 to be disabled. An illustrative screen 660 which may be displayed on the user interface 122 is illustrated in FIG. 31. According to the illustrative screen 660 of FIG. 30, buttons 661-664 have been selected thus enabling the first four lower output receptacles 106c-f while buttons 665-666 have not been selected thus disabling the fifth and sixth lower output receptacles 106g-h. Alternatively, the disable pockets routine automatically disables the inoperable output receptacle(s) 106. Thereafter, the operation of the currency handling device 100 commences. As each bill is transported though the evaluation region 108, information concerning each bill is determined at step 606. Such information can include denomination, currency type, or authenticity. Next, based on the determined information concerning the bill, an output receptacle 106 to which the device 100 normally transports that bill is designated at step 608. The designated output receptacle 106 is determined pursuant to the particular mode of operation. For example, a particular mode of operation may designate the first lower output receptacle 106c for U.S. \$1 bills and the second lower output receptacle 106d for \$1 Canadian bills. The designated output receptacle (designated pursuant to the mode of

operation) is checked against the disabled output receptacle (disable pursuant to the disable pockets routine) at step 608. If the designated output receptacle 106 is not the disabled output receptacle, the bill is directed to the designated output receptacle 106 at step 612. If the designated output receptacle is the disabled output receptacle, the bill is  
5 directed to the output receptacle designated for no call bills – typically, one of the two upper output receptacles 106a, b is designated for no calls.

Referring now to FIG. 28, the operation of the currency handling device pursuant to another embodiment of the disable pockets routine 620 will be described. Again, before implementing the disable pockets routine 620, the user of the currency handling  
10 device 100 determines that it is necessary to disable one or more of the output receptacles 106 of the device 100. Upon deciding to process a batch of currency bills, the user inputs or selects (via the user interface 122) a mode of operation at step 622. At step 624, the user instructs the device 100 to disable one or more of the output receptacles 106. According to alternative embodiments, steps 622 and 624, or steps 602  
15 and 604 with regard to FIG. 27, can be performed in the reverse order. Again, step 624 may include designating the specific output receptacle(s) to be disabled. Alternatively, the disable pockets routine 620 at step 624 automatically disables the inoperable output receptacle(s). At step 626, the output receptacle designations pursuant to the selected mode of operation (e.g., U.S. \$10 bills are directed to the third lower output receptacle  
20 106e) are updated to reflect the disabling of the output receptacle(s). For example, pursuant to one mode of operation, the third lower output receptacle 106e is designated to receive U.S. \$10 bills and the second upper output receptacle 106b may be designated to receive no call bills. At step 626, the designation of the second upper output receptacle 106b is updated to include U.S. \$10 bills. In one embodiment of the disable  
25 pockets routine 620, the disabled output receptacles are replaced with those output receptacles 106 assigned to bills triggering error conditions (e.g., no calls) are directed such as either of the two upper output receptacles 106a-b. Alternatively, step 626 may include selecting the particular output receptacle(s) 106 to replace the disabled output receptacles. Thereafter, the operation of the output receptacles is commenced. At step  
30 628, information concerning each of the bills is determined such as bill denomination. The determined information is used to designate to which output receptacle a particular bill will be directed at step 632. For example, bills determined to be U.S. \$100 bills are

directed to lower output receptacles 106h. And at step 632, the device 100 directs the bill to the designated output receptacle 106.

Pursuant to one mode of operation, an operator can direct, via the control unit 120 at step 602, that a batch of bills be processed such that stacks of U.S. \$1, \$5, \$10, \$20, \$50, and \$100 bills are denominated, counted, authenticated, and directed into lower output receptacles 106c-106h, respectively. Other bills such as U.S. \$2 bills, currency bills from other countries that have been mixed into the batch of bills, and non-identifiable bills (*e.g.*, no calls) are directed to the second upper output receptacle 106b. Lastly those U.S. \$1, \$5, \$10, \$20, \$50, and \$100 bills determined to be non-authentic (*e.g.*, suspect documents) are directed to the first upper output receptacle 106a. The above-described mode of operation is simply one example of the manner in which the currency handling machine 100 processes currency bills. The currency handling device 100 having eight output receptacles 106a-106h provides a great deal of flexibility to the user. And in other alternative embodiments of the currency handling device 100, numerous different combinations for processing documents are available. Upon a user implementing the disable pockets routine, an output pocket – the first lower output receptacle 106c, for example – is disabled. Accordingly, during the processing of each of the bills in the batch are processed as described above except that U.S. \$1 bills are directed into the second upper output receptacle 106b along with those bill determined to be strangers.

As indicated above, in alternative embodiments of the disable pockets routine, the user can designate the output receptacle to which the bills normally directed to one or more disabled pocket are to be directed. In such an embodiment, upon selection of the disable pockets routine, the device 100 may prompt the user via the user interface 122 to specify the alternative output receptacle(s) 106 to which to direct bills otherwise directed to the disabled output receptacle(s) 106. For example, using the above-described scenario, both U.S. \$1 and \$5 bills may be directed to the second lower output receptacle 106d when the first lower output receptacle 106c is disabled. Such an embodiment may be advantageous if the user anticipates a low volume of U.S. \$1 and \$5 bills. The user can vary the output receptacle(s) 106 to which bills otherwise directed to disabled output receptacles are directed in a manner best suited to the particular application.

The disable pockets routine provides a temporary solution to remedy of the inoperability of one of the output receptacles. The users of the currency handling device



100 can continue to process currency bills while awaiting the arrival of spare parts and/or waiting for repairs to take place.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and  
5 herein described in detail. It should be understood, however, that it is not intended to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

**WHAT IS CLAIMED IS:**

1. A currency handing device having a transport mechanism adapted to transport currency bills from an input receptacle to a plurality of output receptacles.
2. An apparatus for transferring a plurality of documents from a first  
5 compartment to a second compartment, the apparatus comprising:  
a plunger assembly, the plunger assembly including a paddle being adapted to contact the documents;  
at least one outwardly extending arm hingedly connected to the plunger assembly;  
a gate disposed between the first compartment and the second compartment, the  
10 gate having an open position and a closed position, the gate being adapted to form a document supporting surface when in the closed position;  
at least one lever extending from the gate, the lever being in a first position when the gate is in the closed position and the lever being in a second position when the gate is in the open position; and  
15 wherein the gate is adapted to move from the closed position to the open position when the paddle urges the documents against the gate from the first compartment towards the second compartment, and wherein the arm is adapted to move the lever from the second position to the first position to move the gate from the open position to the closed position when the paddle retracts from the second compartment to the first compartment.
- 20 3. The apparatus of claim 2 wherein the gate comprises:  
a rotatable shaft extending transversely across an opening of the second compartment; and  
a shutter connected to the shaft.
4. The apparatus of claims 2 or 3 further comprising a spring coupled to the  
25 lever and adapted to maintain the gate in the open and the closed position.
5. The apparatus of claims 2, 3, or 4 further comprising a stacker wheel being adapted to stack documents upon the gate.
6. The apparatus of claims 2, 3, 4, or 5 wherein the gate comprises:  
first and second parallel rotatable shafts extending transversely across an opening  
30 of the second compartment;  
a first shutter connected to the first shaft; and  
a second shutter connected to the second shaft.

7. The apparatus of claim 6 wherein the at least one lever comprises a first lever extending from the first shaft and a second lever extending from the second shaft, first and second levers being in the first position when the gate is closed and in the second position when the gate is open; and wherein the at least one arm includes first and second arms extending from the plunger assembly to move the first and second levers from the second position to the first position to close the first and second shutters when the paddle retracts from the second compartment to the first compartment.

8. The apparatus of claims 2, 3, 4, 5, or 6 wherein the plunger assembly further comprises a resilient member adapted to urge the arm away from the plunger assembly.

9. The apparatus of claim 8 wherein the resilient member is a spring.

10. The apparatus of claims 2, 3, 4, 5, 6, or 8 further comprising a rigid support member, wherein the plunger assembly is slidably engaged to the rigid support member.

11. The apparatus of claim 10 further comprising a rigid guide member, wherein the plunger assembly is slidably engaged to the rigid guide member.

12. An apparatus for transferring a plurality of documents from a first compartment to a second compartment comprising:

- a bidirectionally moveable base having a front, a first side, and a second side;
- a paddle extending laterally from the front of the base;
- a first arm hingedly protruding from the first side of the base;
- a second arm hingedly protruding from the second side of the base;
- a gate disposed between the first compartment and the second compartment forming a document supporting surface, the gate comprising a first shutter and a second shutter, wherein the first shutter and the second shutter are generally parallel when the gate is in an open position, and wherein the first shutter and the second shutter are generally coplanar when the gate is in a closed position;

a first lever operatively associated with the first shutter, the first lever being in a first position when the gate is in the closed position and the first lever being in a second position when the gate is in the open position;

a second lever operatively associated with the second shutter, the second lever being in a first position when the gate is in the closed position and the second lever being in a second position when the gate is in the open position; and

wherein the gate moves from the closed position to the open position when the paddle

- 5 urges the documents in the first compartment against the gate towards the second compartment, and wherein the first and second arms move the first and second levers from the second position to the first position to move the gate from the open position to the closed position when the paddle retracts from the second compartment to the first compartment.

- 10 13. The apparatus of claims 2, 3, 4, 5, 6, 8, 9, or 12 further comprising a belt adapted to bidirectionally drive the plunger assembly.

14. The apparatus of claim 13 wherein the belt is a timing belt.

15 15. The apparatus of claims 2, 3, 4, 5, 6, 8, 9, 12, or 13 further comprising one or more guides adapted to align the documents within the first compartment.

- 16 16. The apparatus of claims 2, 3, 4, 5, 6, 8, 9, 12, 13, or 15 wherein the first compartment, the gate, and the second compartment are each adapted to accommodate bills ranging in size from about 4.39 inches long by about 2.40 inches wide to about 7.17 inches long by about 3.82 inches wide.

- 20 17. The apparatus of claims 12, 13, 15, or 16 wherein the first and second shutters respectively comprise a first and a second parallel rotatable shafts extending transversely across an opening of the second compartment.

18. The apparatus of claims 12, 13, 15, 16, or 17 further comprising:

- 25 a first resilient member attached to the first lever adapted to maintain the first lever in the second position; and

a second resilient member attached to the second lever adapted to maintain the second lever in the second position.

19. The apparatus of claim 18 wherein the first resilient member is a spring and the second resilient member is a spring.

- 30 20. The apparatus of claims 12, 13, 15, 16, 17, or 18 further comprising:  
a first resilient member coupled to the first arm, the first resilient member adapted to urge the first arm away from the base; and

a second resilient member coupled to the second arm, the second resilient member adapted to urge the second arm away from the base.

21. The apparatus of claim 20 further wherein the first resilient member is a spring and the second resilient member is a spring.

5 22. A currency handling device for receiving a plurality of currency bills and rapidly evaluating each of the bills, the device comprising:

an input receptacle being adapted to receive a plurality of bills to be evaluated;

a plurality of output receptacles adapted to receive the bills after the bills have been evaluated, at least one of the output receptacles having a first compartment and a  
10 second compartment, the output receptacle having a gate disposed between the first compartment and the second compartment, the gate having an open position and a closed position, the gate being adapted to form a bill supporting surface when in the closed position, the gate having at least one lever outwardly extending therefrom, the lever being in a first position when the gate is in the closed position and the lever being in a second  
15 position when the gate is in the open position;

a transport mechanism being adapted to transport the bills, one at a time along a transport path, from the input receptacle to the first compartment of one of the output receptacles;

a paddle being adapted to urge the bills from the first compartment towards the  
20 second compartment wherein the paddle presses against the bills and causes the gate to move from the closed position to the open position, and wherein the paddle is adapted to engage the lever to move the gate from the open position to the closed position when the paddle retracts the second compartment to the first compartment;

an evaluating unit being adapted to determine information concerning the bills, the  
25 evaluation unit having at least one sensor positioned along the transport path between the input receptacle and the output receptacles;

an operator interface being adapted to receive operational instructions from a user and to display the information concerning the bills; and

a controller being adapted to couple the operator interface and the evaluation unit, the  
30 controller causing the discriminating unit to operate in one of a plurality of operating modes which determine into which output receptacle each bill is delivered in response to the operational instructions from the user.

23. A currency handling device for receiving a plurality of currency bills and rapidly evaluating each of the bills, the device comprising:

an input receptacle being adapted to receive the plurality of bills to be evaluated, the input receptacle being adapted to accommodate bills ranging in size from about 4.39 inches long by about 2.40 inches wide to about 7.17 inches long by about 3.82 inches wide;

a plurality of output receptacles adapted to receive the bills after the bills have been evaluated, at least one of the output receptacles having a first compartment and a second compartment, the output receptacle having a gate disposed between the first compartment and the second compartment, the gate having an open position and a closed position, the gate being adapted to form a bill supporting surface when in the closed position, the gate having at least one lever outwardly extending therefrom, the lever being in a first position when the gate is in the closed position and the lever being in a second position when the gate is in the open position, each of the first and second compartments being adapted to accommodate bills ranging in size from about 4.39 inches long by about 2.40 inches wide to about 7.17 inches long by about 3.82 inches wide;

a transport mechanism being adapted to transport the bills, one at a time along a transport path, from the input receptacle to the first compartment of one of the output receptacles, the transport mechanism being adapted to accommodate bills ranging in size from about 4.39 inches long by about 2.40 inches wide to about 7.17 inches long by about 3.82 inches wide;

a paddle being adapted to urge the bills from the first compartment towards the second compartment wherein the paddle presses against the bills and causes the gate to move from the closed position to the open position, and wherein the paddle is adapted to engage the lever to move the gate from the open position to the closed position when the paddle retracts the second compartment to the first compartment;

an evaluation unit being adapted to determine information concerning the bills, the evaluation unit having at least one sensor positioned along the transport path between the input receptacle and the output receptacles;

an operator interface being adapted to receive operational instructions from a user and to display the information concerning the bills; and

a controller being adapted to couple the operator interface and the evaluation unit, the controller being adapted to cause the evaluation unit to operate in one of a plurality of operating modes which determine into which output receptacle each bill is delivered in response to the operational instructions from the user.

- 5        24.     The currency handling device of claims 22 or 23 wherein the gate comprises:  
a rotatable shaft extending transversely across an opening of the second compartment;  
and

a shutter connected to the shaft.

25.     The currency handling device of claims 22 or 23 wherein the gate comprises:  
10     a first and a second parallel rotatable shafts extending transversely across an opening  
of the second compartment;

a first shutter connected to the first shaft; and

a second shutter connected to the second shaft.

26.     The currency handling device of claim 25 wherein the at least one lever  
15     comprises a first lever extending from the first shaft and a second lever extending from the  
second shaft, the first and second levers being in the first position when the gate is closed and  
in the second position when the gate is open; and wherein the paddle is adapted to move the  
first and second levers from the second position to the first position to close the first and the  
second shutter when the paddle retracts from the second compartment to the first  
20     compartment.

27.     The currency handling device of claims 22, 23, 24, or 25 further comprising:  
a first resilient member coupled to the first lever, the first resilient member adapted to  
maintain the first lever in the first and the second positions; and

- a second resilient member coupled to the second lever, the second resilient member  
25     adapted to maintain the second lever in the first and the second positions.

28.     The currency handling device of claim 27 wherein the first resilient member  
comprises a spring and the second resilient member comprises a spring.

29.     The currency handling device of claims 22, 23, 24, 25, or 27 further  
comprising a belt being adapted to bidirectionally drive the base.

- 30     30.     The currency handling device of claim 29 wherein the belt is a timing belt.

31.     The currency handling device of claims 22, 23, 24, 25, 27 or 29 further  
comprising one or more guides being adapted to align the bills within the first compartment.

32. The currency handling device of claims 22, 23, 24, 25, 27, 29, 31, or 32 wherein the first compartment further comprises a stacker wheel being adapted to stack the bills upon the gate.

33. The currency handling device of claims 22, 23, 24, 25, 27, 29, 31, or 32  
5 wherein each of the output receptacles further comprises a stacker wheel being adapted to stack the bills within the output receptacles.

34. The currency handling device of claims 22, 23, 24, 25, 27, 29, 31, 32, or 33 further comprising a bill facing mechanism disposed along the transport path between the evaluation region and the plurality of output receptacles, the bill facing mechanism being  
10 adapted to rotate a bill approximately 180°.

35. The currency handling device of claims 22, 24, 25, 27, 29, 31, 32, 33, or 34 wherein the input receptacle, the output receptacles, and the transport mechanism are each adapted to accommodate bills ranging in size from about 4.39 inches long by about 2.40 inches wide to about 7.17 inches long by about 3.82 inches wide.

36. The currency handling device of claims 22, 23, 24, 25, 27, 29, 31, 32, 33, 34,  
15 or 35 wherein the input receptacle further comprises:

a front end and a back end;

a feeder mechanism disposed in the front end of the receptacle, the feeder mechanism being adapted to transfer the bills, one at a time, from the input receptacle; and

20 a first paddle and a second paddle, the first paddle being adapted to urge a first stack of bills towards the feeder mechanism, the second paddle being adapted to urge a second stack of bills towards the feeder mechanism.

37. The currency handling device of claim 30 further comprising a first and a second spring coupled to the first and the second paddles, respectively, the first and second  
25 springs being adapted to bias the first and second paddles, respectively, towards the feeder mechanism.

38. The currency handling device of claim 36 wherein the feeder mechanism comprises at least one stripping wheel.

39. The currency handling device of claims 22, 23, 24, 25, 27, 29, 31, 32, 33, 34,  
30 35, or 36 further comprising a resilient member coupled to the at least one lever, the resilient member being adapted to maintain the gate in the open and the closed position.



40. The currency handling device of claim 39 wherein the resilient member is a spring.

41. A currency evaluation device for monitoring the transportation of bills being evaluated by the device, the device comprising:

- 5       an input receptacle being adapted to receive a stack of bills to be evaluated;  
      a plurality of output receptacles being adapted to receive the bills after the bills have been evaluated;  
      a transport mechanism being adapted to transport the bills along a transport path, one at a time, from the input receptacle to the output receptacles;  
10       an evaluation region being adapted to determine information concerning the bills, the evaluation region including at least one bill information sensor positioned along the transport path between the input receptacle and the output receptacle;  
      a plurality of bill passage sensors sequentially disposed along the transport mechanism, each of the plurality of sensors being adapted detect the passage of a bill as each bill is  
15       transported past each sensor, each of the plurality of sensors being adapted to generate a signal upon the detection of each bill as each bill is transported past each sensor;  
      an encoder adapted to produce an encoder count for each incremental movement of the transport mechanism; and  
      a controller being adapted to track the movement of each bill along the transport path,  
20       the controller being electrically coupled to the encoder, the transport mechanism, and each of the plurality of bill passage sensors, the controller being adapted to control the operation of the transport mechanism, the controller being adapted to calculate a range of encoder counts in which each of the bills is to be transported past each one of the plurality of position sensors, the controller being adapted to receive the signal from each of the plurality of position sensors,  
25       the controller being adapted to recalculate the range of encoder counts in which each of the bills is to be transported past each subsequent bill passage sensor after receiving the signal from each of the plurality of bill passage sensors, the controller being adapted to suspend the operation of the transport mechanism when the controller does not receive the signal from one of the plurality of bill passage sensors within the calculated range of encoder counts.
- 30       42. The currency evaluation device of claim 41 wherein the controller is adapted to produce a signal indicative of which of the plurality of bill passage sensors failed to detect the presence of a bill upon the suspension of the operation of the transport mechanism, and

wherein the currency evaluation device further comprises a user interface being adapted to receive the signal from the controller, the user interface being adapted to communicate to a user which of the plurality of bill passage sensors failed to detect the presence of a bill.

43. A currency evaluation device for monitoring the transportation of bills being  
5 evaluated by the device, the device comprising:

an input receptacle being adapted to receive a stack of bills to be evaluated;

a plurality of output receptacles being adapted to receive the bills after the bills have  
been evaluated;

- a transport mechanism being adapted to transport the bills along a transport path, one  
10 at a time, from the input receptacle to the output receptacles;

an evaluation region being adapted to determine information concerning the bills, the  
evaluation region including at least one bill information sensor positioned along the transport  
path between the input receptacle and the output receptacle;

- a plurality of bill passage sensors sequentially disposed along the transport mechanism,  
15 each of the plurality of sensors being adapted detect the passage of a bill as each bill is  
transported past each bill position sensor, each of the plurality of sensors being adapted to  
generate a signal upon the detection of each bill as each bill is transported past each sensor, the  
plurality of sensors including a first and a second bill passage sensor;

- an encoder adapted to produce an encoder count for each incremental movement of  
20 the transport mechanism; and

- a controller being adapted to track the movement of each bill along the transport path  
and to control the operation of the transport path, the controller being electrically coupled to  
the encoder, the transport mechanism, and each of the plurality of bill passage sensors, the  
controller being adapted to receive a signal from each of the plurality of bill passage sensors,  
25 the controller being adapted to calculate the number of encoder counts required for a bill to be  
transported past the second position sensor upon receiving a signal from the first position  
sensor, the controller being adapted to suspend the operation of the transport mechanism when  
the controller does not receive a signal from the second bill passage sensor within an  
acceptable deviation from the calculated number of encoder counts required for the bill to be  
30 transported past the second bill passage sensor.

44. The currency evaluation device of claim 43 wherein the plurality of bill  
passage sensors includes a third bill passage sensor, the controller being adapted to

calculate the number of encoder counts required for a bill to be transported past the third bill passage sensor after receiving a signal from the second bill passage sensor, the controller being adapted to suspend operation of the transport mechanism when the controller does not receive a signal from the third bill passage sensor within an acceptable deviation from the calculated number of encoder counts required for the bill to be transported past the third bill passage sensor

45. A currency evaluation device for monitoring the transportation of bills being evaluated by the device, the device comprising:

an input receptacle being adapted to receive a stack of bills to be evaluated;

a plurality of output receptacles being adapted to receive the bills after the bills have been evaluated;

a transport mechanism being adapted to transport the bills along a transport path, one at a time, from the input receptacle to the output receptacles;

an evaluation region being adapted to determine information concerning the bills, the evaluation region including at least one bill information sensor positioned along the transport path between the input receptacle and the output receptacle;

a plurality of bill passage sensors sequentially disposed along the transport mechanism, each of the plurality of sensors being adapted detect the passage of a bill as each bill is transported past each bill position sensor, each of the plurality of sensors being adapted to generate a signal upon the detection of each bill as each bill is transported past each sensor, the plurality of sensors including a first and a second bill passage sensor; and

a controller being adapted to track the movement of each bill along the transport path and to control the operation of the transport path, the controller being electrically coupled to the transport mechanism and each of the plurality of bill passage sensors, the controller being adapted to receive a signal from each of the plurality of bill passage sensors, the controller being adapted to calculate the time required for a bill to be transported past the second position sensor upon receiving a signal from the first position sensor, the controller being adapted to suspend the operation of the transport mechanism when the controller does not receive a signal from the second bill passage sensor within an acceptable deviation from the calculated number of time required for the bill to be transported past the second bill passage sensor.

46. The currency evaluation device of claims 43, 44, or 45 wherein the controller is adapted to produce a signal indicative of the second bill passage sensor not detecting the passage of a bill upon the suspension of the operation of the transport mechanism, and wherein the currency evaluation device further comprises a user interface adapted to receive the signal from the controller, the user interface being adapted to communicate to a user that the second bill passage sensor failed to detect the passage of a bill.

47. The currency evaluation device of claims 43 or 44 wherein the plurality of bill passage sensors includes a third bill passage sensor, the controller being adapted to calculate the time required for a bill to be transported past the third bill passage sensor after receiving a signal from the second bill passage sensor, the controller being adapted to suspend operation of the transport mechanism when the controller does not receive a signal from the third bill passage sensor within an acceptable deviation from the calculated time required for the bill to be transported past the third bill passage sensor.

48. The currency evaluation device of claims 43, 44, or 47 wherein the controller is adapted to produce a signal indicative of the third bill passage sensor not detecting the passage of a bill upon the suspension of the operation of the transport mechanism, and wherein the currency evaluation device further comprises a user interface adapted to receive the signal from the controller, the user interface being adapted to communicate to a user that the third bill passage sensor failed to detect the passage of a bill.

49. An apparatus for feeding a plurality of stacked currency bills into a currency handling device, the apparatus comprising:

a receptacle being adapted to receive a plurality of stacked bills, the receptacle having a front end and a back end;

a feeder mechanism disposed in the front end of the receptacle, the feeder mechanism being adapted to transfer the bills, one at a time, from the receptacle to the currency handling device; and

a first paddle and a second paddle, the first paddle being adapted to urge a first stack of bills towards the feeder mechanism, the second paddle being adapted to urge a second stack of bills towards the feeder mechanism.

50. The apparatus of claim 49 further comprising a first spring coupled to the first paddle and a second spring coupled to the second paddle, the first and second springs each being adapted to urge the first and second paddles, respectively, towards the feeder mechanism.

5 51. An apparatus for feeding a plurality of stacked currency bills into a currency handling device, the apparatus comprising:

a receptacle being adapted to receive a plurality of stacked bills, the receptacle having a first and a second side, a front end, and a floor;

a feeder mechanism disposed in the front end of the receptacle, the feeder  
10 mechanism being adapted to transfer the bills, one at a time, from the receptacle to the currency handling device;

a first rigid member disposed along the first side;

a second rigid member disposed along the second side;

a first paddle pivotally and slidably engaged to the first rigid member, the first  
15 paddle having a substantially flat surface being adapted to contact a plurality of stacked bills;

a second paddle pivotally and slidably engaged to the second rigid member, the second paddle having a substantially flat surface being adapted to contact a plurality of stacked bills;

20 a first resilient member coupled to the first paddle, the first resilient member being adapted to bias the first paddle towards the front end of the receptacle;

a second resilient member coupled to the second paddle, the second resilient member being adapted to bias the second paddle towards the front end of the receptacle.

52. The apparatus of claims 49 or 51 wherein the receptacle has a floor and  
25 the first paddle and second paddle each have a bottom surface, the apparatus further comprising:

at least one track disposed in the floor of the receptacle, the track having a width;

at least one channel disposed within the bottom surface of the first paddle, the width of the channel being slightly larger than the width of the track, the channel being  
30 adapted to fit around the track, the channel being adapted to slide along the track; and

at least one channel disposed within the bottom surface of the second paddle, the width of the channel being slightly larger than the width of the track, the channel being adapted to fit around the track, the channel being adapted to slide along the track.

53. The apparatus of claims 49, 51, or 52 further comprising a handle coupled  
5 to the first paddle.

54. The apparatus of claims 49, 51, 52, or 53 further comprising a handle coupled to the second paddle.

55. The apparatus of claims 49, 51, 52, 53, or 54 wherein the first paddle has a bottom surface, the apparatus further comprising a roller attached to the first paddle, the  
10 roller extending slightly beyond the bottom surface of the of the first paddle, the roller being adapted to roll along the floor of the receptacle as the first paddle urges the plurality of stacked bills towards the feeder mechanism.

56. The apparatus of claims 49, 51, 52, 53, 54, or 55 wherein the second paddle has a bottom surface, the apparatus further comprising a roller attached to the  
15 second paddle, the roller extending slightly beyond the bottom surface of the of the second paddle, the roller being adapted to roll along the floor of the receptacle as the second paddle urges the plurality of stacked bills towards the feeder mechanism.

57. The apparatus of claims 49, 51, 52, 53, 54, 55, or 56 wherein the receptacle and the feeder mechanism are adapted to accommodate bills ranging in size  
20 from about 4.39 inches long by about 2.40 inches wide to about 7.17 inches long by about 3.82 inches.

58. The apparatus of claims 49, 51, 52, 53, 54, 55, 56, or 57 wherein the feeder mechanism comprises at least one stripping wheel.

59. The apparatus of claim 58 wherein the at least one stripping wheel  
25 comprises two stripping wheels.

60. A method for loading a plurality of stacks of currency bills into a currency handling device, the currency handling device having an input receptacle being adapted to receive a plurality of stacks of bills, the input receptacle having a front end and a back  
30 end, the input receptacle having a feeder mechanism disposed in the front end of the receptacle, the feeder mechanism being adapted to transfer the bills, one at a time, from the input receptacle into the currency handling device, the input receptacle having a first

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paddle and a second paddle each being adapted to urge the plurality of stacks of bills towards the feeder mechanism, the method comprising:

retracting the first paddle toward the back end of the receptacle;

placing a first stack of bills in the input receptacle between the first paddle and the

5 feeder mechanism;

releasing the first paddle, the first paddle urging the first stack of bills towards the front end of the receptacle;

retracting the second paddle towards the back end of the receptacle and behind the first paddle;

10 placing a second stack of bills in the input receptacle between the first paddle and the second paddle;

releasing the second paddle, the second paddle urging the second stack of bills towards the front end of the receptacle and into the back of the first paddle;

withdrawing the first paddle from the input receptacle so that the first and the

15 second stack of bills form a combined stack; and

the second paddle urging the combined stack of bills towards the front end of the receptacle.

61. A method for loading a plurality of stacks of currency bills into a currency handling device, the currency handling device having an input receptacle being adapted to receive a plurality of stacks of bills, the input receptacle having a front end and a back  
20 end, the input receptacle having a feeder mechanism disposed in the front end of the input receptacle, the feeder mechanism being adapted to transfer the bills, one at a time, from the receptacle into the currency handling device, the input receptacle having a first paddle and a second paddle each being adapted to urge the stacked bills towards the feeder  
25 mechanism, the method comprising:

retracting the first and the second paddle toward the back of the receptacle;

placing a first stack of bills in the input receptacle between the first paddle and the feeder mechanism;

30 releasing the first and the second paddle so that the first paddle presses up against the first stack of bills and the second paddle presses against the first paddle;

the first paddle urging the first stack of bills towards the front end of the receptacle;

retracting the second paddle towards the back end of the receptacle;  
placing a second stack of bills in the input receptacle between the first paddle and  
the second paddle;

- positioning the second paddle against the second stack of bills to that the second  
5 stack of bills presses against the first paddle;

the second paddle urging the second stack of bills towards the front end of the  
receptacle and into the first paddle;

upwardly pivoting the first paddle out of the input receptacle so that the first and  
the second stacks of bills form a combined stack;

- 10 the second paddle urging the combined stack of bills towards the front end of the  
receptacle;

retracting the first paddle towards the back end of the receptacle;  
downwardly pivoting the first paddle into the input receptacle; and  
positioning the first paddle behind the second paddle.

- 15 62. The method of claims 60 or 61 wherein the feeder mechanism comprises at  
least one stripping wheel.

63. The method of claims 60, 61, or 62 wherein the receptacle has a floor, and  
the first and the second paddle each have at least one channel disposed therein being  
adapted to slide along a corresponding track disposed in the floor of the receptacle.

- 20 64. The method of claims 60, 61, 62, 63 wherein the first and the second  
paddle each have a handle attached thereto.

65. The method of claims 60, 61, 62, 63, or 64 wherein the input receptacle  
has a floor, and wherein the first and the second paddle each have a roller attached  
thereto, the roller being adapted to roll along a floor of the receptacle.

- 25 66. The method of claims 60, 61, 62, 63, 64, or 65 wherein the receptacle and  
the feeder mechanism are adapted to accommodate bills ranging in size from about 4.39  
inches long by about 2.40 inches wide to about 7.17 inches long by about 3.82 inches.

67. The method of claims 60, 61, 62, 63, 64, 65, or 66 wherein the input  
receptacle further includes a first spring coupled to the first paddle and a second spring  
30 coupled to the second paddle, the first and second springs each being adapted to urge the  
first and second paddles, respectively, towards the feeder mechanism.



68. An apparatus for rotating the orientation of a currency bill approximately 180°.

69. An apparatus for rotating the orientation of a bill approximately 180°, the apparatus comprising:

5 a first belt having a bill transport portion and a return portion, the first belt having a first end and second end, the second end of first belt being twisted approximately 180° in relation to the first end of the first belt;

a second belt having a bill transport portion and a return portion, the second belt having a first end and second end, the bill transport portion of the first belt being disposed  
10 adjacent to the bill transport portion of the second belt, the second end of second belt being twisted approximately 180° in relation to the first end of the second belt;

a bill transport path being defined by the bill transport portions of the first and the second belts, the bill transport path having an inlet and an outlet, wherein the outlet of the bill transport path is twisted approximately 180° in relation to the inlet; and

15 a plurality of guides disposed adjacent to the bill facing path, the plurality of guides being adapted to support the outer portions of the bill which extend beyond a width of the first and the second belts as the bill is being transported along the transport path.

70. The apparatus of claim 69 further comprising a first pair of rollers, one of  
20 the first pair of rollers being disposed adjacent the inlet, the other of the first pair of rollers being disposed adjacent the outlet, the first belt being disposed around the first pair of rollers.

71. The apparatus of claim 70 further comprising a second pair of rollers, one of the second pair of rollers being disposed adjacent the inlet, the other of the second pair  
25 of rollers being disposed adjacent the outlet, the second belt being disposed around the second pair of rollers.

72. The apparatus of claims 69 or 70 further comprising a first belt guide being adapted to guide the return portion of the first belt away from the transport path.

73. The apparatus of claim 72 further comprising a second belt guide being  
30 adapted to guide the return portion of the second belt away from the transport path.

74. An apparatus for rotating the orientation of a currency bill approximately 180°, the apparatus comprising:

a bill transport path having an inlet and an outlet, the transport path being adapted to transport the bill from the inlet to the outlet, the transport path being defined by opposing surfaces of a first and a second belt, the first and second belts each having a first and a second end, the second end of the first and second belts being twisted

- 5 approximately 180° in relation to the first end of the first and second belts, wherein the inlet of the transport path is rotated approximately 180° in relation to the outlet;

a first pair of rollers, one of the first pair of rollers being disposed adjacent the inlet, the other of the first pair of rollers being disposed adjacent the outlet, the first belt being disposed around the first pair of rollers; and

- 10 a second pair of rollers, one of the second pair of rollers being disposed adjacent the inlet, the other of the second pair of rollers being disposed adjacent the outlet, the second belt being disposed around the first pair of rollers.

75. The apparatus of claims 69, 70, 72, or 74 wherein the first belt comprises a continuous loop.

- 15 76. The apparatus of claims 69, 70, 72, or 74 wherein the second belt comprises a continuous loop.

77. An apparatus for rotating the orientation of a currency bill approximately 180° comprising:

- 20 a first and a second belt having a first end and a second end, each of the first and the second belts forming a continuous loop, each of the first and the second belts having an inner and an outer surface, the first belt being disposed adjacent to the second belt wherein a portion of the outer surfaces of the first and second belts define opposing surfaces of a bill facing path, the bill facing path having an inlet corresponding to the first end of the first and the second belts and an outlet corresponding to the second ends of the first and the second belts, the first and the second belts being twisted together causing the second ends of the first and second belts to be twisted approximately 180° with respect to the first ends of the first and the second belts causing the outlet of the bill facing path to be twisted approximately 180° with respect to the inlet;

- 30 a plurality of guides disposed adjacent to the bill facing path, the plurality of guides being adapted to support the outer portions of a bill which extend beyond a width of the first and the second belts as the bill is being transported along the transport path;

a first pair of rollers, one of the first pair of rollers being disposed adjacent the inlet, the other of the first pair of rollers being disposed adjacent the outlet, the first belt being disposed around the first pair of rollers; and

- 5 a second pair of rollers, one of the second pair of rollers being disposed adjacent the inlet, the other of the second pair of rollers being disposed adjacent the outlet, the second belt being disposed around the first pair of rollers.

78. The apparatus of claims 74 or 77 wherein the first belt includes a return portion, the apparatus further comprising a first belt guide being adapted to guide a portion of the first belt not defining the bill transport path away from the transport path.

- 10 79. The apparatus of claims 74, 77, or 78 wherein the second belt includes a return portion, the apparatus further comprising a second belt guide being adapted to guide a portion of the second belt not defining the bill transport path away from the transport path.

80. A currency evaluation device for receiving a plurality of currency bills and rapidly evaluating each of the bills, the device comprising:

an input receptacle being adapted to receive a plurality of bills to be evaluated;

- one or more output receptacles adapted to receive the bills after the bills have been evaluated, at least one of the output receptacles having a first compartment and a second compartment, the output receptacle having a gate disposed between the first  
20 compartment and the second compartment, the gate having an open position and a closed position, the gate being adapted to form a bill supporting surface when in the closed position, the gate having at least one lever outwardly extending therefrom, the lever being in a first position when the gate is in the closed position and the lever being in a second position when the gate is in the open position;

- 25 a transport mechanism being adapted to transport the bills, one at a time along a transport path, from the input receptacle to the first compartment of one of the output receptacles;

- a bill facing mechanism disposed along the transport path between the input receptacle and the output receptacles, the bill facing mechanism including a first and  
30 a second belt having a first end and a second end, each of the first and the second belts forming a continuous loop, each of the first and the second belts having an outer surface, the first belt being disposed adjacent to the second belt wherein a portion of the outer

- surfaces of the first and second belts define a bill facing path, the bill facing path having an inlet corresponding to the first end of the first and the second belts and an outlet corresponding to the second ends of the first and the second belts, the first and the second belts being twisted together causing the second ends of the first and second belts to be
- 5 twisted approximately  $180^\circ$  with respect to the first ends of the first and the second belts causing the outlet of the bill facing path to be twisted approximately  $180^\circ$  with respect to the outlet of the bill facing path, the bill facing mechanism including a plurality of guides disposed adjacent to the bill facing path, the plurality of guides being adapted to support the outer portions of the bill which extend beyond a width of the first and the second belts
- 10 as the bill is being transported along the transport path;

an evaluating unit being adapted to determine information concerning the bills, the evaluation unit having at least one sensor positioned along the transport path between the input receptacle and the output receptacles;

- an operator interface being adapted to receive operational instructions from a user and
- 15 to display the information concerning the bills; and

a controller being adapted to couple the operator interface and the evaluation unit, the controller causing the discriminating unit to operate in one of a plurality of operating modes which determine into which output receptacle each bill is delivered in response to the operational instructions from the user.

- 20 81. The device of claim 80 wherein the first belt includes a return portion, the apparatus further comprising a first belt guide being adapted to guide the return portion of the first belt away from the transport path.

82. The device of claims 80 or 81 wherein the second belt includes a return portion, the apparatus further comprising a second belt guide being adapted to guide the
- 25 return portion of the second belt away from the transport path.

83. The device of claims 80, 81, or 82 further comprising a first pair of rollers, one of the first pair of rollers being disposed adjacent the inlet, the other of the first pair of rollers being disposed adjacent the outlet, the first belt being disposed around the first pair of rollers.

- 30 84. The device of claims 80, 81, 82, or 83 further comprising a second pair of rollers, one of the second pair of rollers being disposed adjacent the inlet, the other of the

second pair of rollers being disposed adjacent the outlet, the second belt being disposed around the first pair of rollers.

85. A method of creating identifiable groups of currency bills within a stack of currency bills with a currency evaluation device having a bill facing mechanism, the method comprising:

stacking a predetermined number of bills in at least one output receptacle such that the predetermine number of bills have a face-up orientation;

stacking a predetermined number of bills in the at least one output receptacle such that the predetermine number of bills have a down-up orientation; and

repeating the above method.

86. A method of creating identifiable smaller stacks of currency bills within a larger stack of currency bills using a currency evaluation device, the method comprising:

(a) receiving a stack of currency bills in an input receptacle;

(b) transporting the bills from the input receptacle, one at a time, past an evaluating unit to at least one output receptacle;

(c) identifying the face orientation of each of the bills with the evaluating unit; and either

(1) maintaining the orientation of a bill when the orientation of the bill matches a target orientation; or

(2) reversing the orientation of a bill when the orientation of the bill does not match the target orientation;

(d) stacking a predetermined number of bills in the at least one output receptacle, the predetermined number of bills having a common face orientation;

(e) redefining the target orientation to be the other of the two face orientations after the predetermined number of bills have been transported to the at least one output receptacle; and

(f) repeating (b), (c), (d), and (e), until each of the bills are transported from the input receptacle.

87. A method of creating identifiable smaller stacks of currency bills within a larger stack of currency bills using a currency evaluation device, the method comprising:

(a) defining a target orientation to be one of two face orientations, one of the two face orientations being face-down, the other of the two face orientations being face-up;

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- (b) receiving a stack of currency bills in an input receptacle;
  - (c) transporting each of the bills from the input receptacle, one at a time, past an evaluating unit to at least one output receptacle;
  - (d) identifying the face orientation of each of the bills with the evaluating unit; and
  - 5 either
    - (1) maintaining the orientation of the bill when the orientation of the bill matches the target orientation; or
    - (2) reversing the orientation of the bill when the orientation of the bill does not match the target orientation;
  - 10 (e) stacking a predetermined number of bills in the at least one output receptacle, the predetermined number of bills having a common face orientation;
  - (f) redefining the target orientation to be the other of the two face orientations after a predetermined number of bills having been transported to the at least one output receptacle; and
  - 15 (g) repeating (c), (d), (e), and (f) until each of the bills are transported from the input receptacle.
88. A method of creating identifiable smaller stacks of currency bills within a larger stack of currency bills with a currency evaluation device, the method comprising:
- receiving a stack of currency bills in an input receptacle;
  - 20 transporting each of the bills from the input receptacle, one at a time, past an evaluating unit to at least one output receptacle;
  - identifying the face orientation of each of the bills with the evaluating unit, the face orientation of the bills being one of two face orientations, one of the two face orientations being face-down, the other of the two face orientations being face-up;
  - 25 defining a target orientation to be the face orientation of a first bill transported from the input receptacle;
  - comparing the face orientation of each of the bills with the target orientation;
  - maintaining the face orientation of a bill when the face orientation of the bill matches the target orientation;
  - 30 reversing the face orientation of a bill when the face orientation of the bill does not match the target orientation;

stacking a predetermined number of bills in the at least one output receptacle, the predetermined number of bills having a common face orientation;

redefining the target orientation to be the other of the two face orientations after the predetermined number of bills having a common face orientation have been stacked in the at

5 least one output receptacle; and

repeating the above method, beginning with transporting the bills until each of the bills are transported from the input receptacle.

89. A method of creating identifiable smaller stacks of currency bills within a larger stack of currency bills with a currency evaluation device, the method comprising:

10 receiving a stack of currency bills of a plurality of denominations in an input receptacle;  
transporting the bills from the input receptacle, one at a time, past an evaluating unit to a plurality of output receptacles, the plurality of output receptacles corresponding to the plurality of denominations;

assigning a target orientation to each of the plurality of output receptacles,

15 defining the target orientation assigned to each of the plurality of output receptacles to be one of two face orientations, one of the two face orientations being face-down, the other of the two face orientations being face-up;

determining the denomination and face orientation of each of the bills with the evaluating unit;

20 comparing the face orientation of a bill with the target orientation assigned to the output receptacle corresponding to the determined denomination of the bill;

maintaining the orientation of the bill when the orientation of the bill matches the target orientation;

25 reversing the orientation of the bill when the orientation of the bill does not match the target orientation;

routing the bill to the output receptacle corresponding to the determined denomination of the bill;

redefining the target orientation assigned to an output receptacle to be the other of the two face orientations after a predetermined number of bills of having a denomination

30 corresponding to the output receptacle have been routed to the output receptacle with a common face orientation; and

repeating the above method, beginning with transporting the bills until each of the bills are transported from the input receptacle.

90. A method of creating identifiable smaller stacks of currency bills within larger stacks of currency bills using a currency evaluation device, the method comprising:

- 5 (a) defining a target face orientation to be one of two face orientations for each of a plurality of currency bill denominations, one of the two face orientations being face-down, the other of the two face orientations being face-up;
- (b) receiving a stack of currency bills of a plurality of denominations in an input receptacle;
- 10 (c) transporting the bills from the input receptacle, one at a time, past an evaluating unit to a plurality of output receptacles, the plurality of output receptacles corresponding to the plurality of denominations;
- (d) determining the denomination of each of the currency bills with the evaluating unit;
- (e) identifying the face orientation of each of the bills with the evaluating unit; and
- 15 either
  - (1) maintaining the orientation of a bill when the orientation of the bill matches the target orientation associated with the determined denomination of the bill; or
  - (2) reversing the orientation of a bill when the orientation of the bill does not
- 20 match the target orientation associated with the determined denomination of the bill;
- (f) routing each of the bills to one of the plurality of output receptacles corresponding to the determined denomination of the bill;
- (g) stacking a predetermined number of bills in the plurality of output receptacles corresponding to the determined denominations of the bills;
- 25 (h) redefining the target orientation associated with a particular denomination after a predetermined number of bills have been routed to the particular output receptacle corresponding to the particular denomination; and
- (i) repeating (c), (d), (e), (f), (g), and (h) until each of the bills are transported from the input receptacle.
- 30 91. A method of creating identifiable groups of currency bills within a stack of currency bills with a currency evaluation device having a bill facing mechanism, the method comprising:



receiving a stack of currency bills in an input receptacle;  
transporting each of the bills from the input receptacle, one at a time, past an  
evaluating unit to at least one output receptacle;  
identifying the face orientation of each of the bills with the evaluating unit;  
5 stacking the bills in the at least one output receptacle such that the face orientation of  
each group of bills stacked in the at least one output receptacles alternates from the previous  
group of bills stacked in the at least one output receptacle.

92. The method of claims 86, 87, 88, 89, 90, or 91 further comprising  
determining the authenticity of each of the currency bills.

10 93. The method of claim 92 further comprising off-sorting a bill when the  
authenticity of the bill cannot be determined.

94. The method of claims 86, 87, 88, or 91 further comprising determining the  
denomination of each of the currency bills.

15 95. The method of claim 94 further comprising off-sorting a bill when the  
denomination of the bill cannot be determined.

96. The method of claims 86, 87, 88, or 91 wherein the at least one output  
receptacle comprises a plurality of output receptacles.

97. The method of claim 96 further comprising:  
determining the authenticity of each of the currency bills; and  
20 routing a bill to a particular one of the plurality of output receptacles when the  
authenticity of the bill cannot be determined.

98. The method of claim 96 further comprising:  
determining the denomination of each of the currency bills; and  
routing a bill to a particular one of the plurality of output receptacles when the  
25 denomination of the bill cannot be determined

99. The method of claims 94 or 98 further comprising totaling the value of the  
currency bills transported to the output receptacle.

100. The method of claim 86 further comprising defining an initial target  
orientation to be the face orientation of a first bill transported from the input receptacle.

30 101. The method of claims 86, 87, 88 or 89 wherein reversing the face  
orientation of a bill further comprises reversing the face orientation of a bill with a bill facing  
mechanism.

102. The method of claim 83 or 90 wherein defining a target orientation further comprises defining the target orientation to be the face orientation of a first bill transported from the input receptacle.

103. A currency evaluation device for receiving a plurality of bills and  
5 evaluating and arranging the bills in a stack, wherein the stack includes a plurality of identifiable smaller stacks, the device comprising:
- an input receptacle adapted to receive a plurality of bills to be processed;
  - at least one output receptacle adapted to receive the bills after the bills have been processed;
  - 10 a transport mechanism adapted to transport the bills, one at a time, from the input receptacle to the at least one output receptacle;
  - an evaluating unit adapted to determine the face orientation of each of the bills and to produce a signal indicative of the face orientation of each of the bills;
  - a bill facing mechanism adapted to rotate a bill approximately 180° to reverse the  
15 face orientation of a bill; and
  - a controller adapted to receive the signal from the evaluating unit and to cause the transport mechanism to direct a bill to the bill facing mechanism when the face orientation of the bill does not match a target orientation so that a predetermined number of bills are transported to the output receptacle with a common face orientation, the controller being  
20 adapted to redefine the target orientation after a predetermined number of bills are transported to the output receptacle with a common face orientation.

104. A currency evaluation device for receiving a plurality of bills of mixed denominations and evaluating and arranging the bills in larger stacks, wherein the larger stacks include a plurality of identifiable smaller stacks of currency bills, the device  
25 comprising:
- an input receptacle adapted to receive a stack of bills of a plurality of denominations;
  - a plurality of output receptacles adapted to receive the bills after the bills have been evaluated, the plurality of output receptacles corresponding to the plurality of  
30 denominations;
  - a transport mechanism adapted to transport the bills, one at a time, from the input receptacle to the plurality of output receptacles;

an evaluating unit adapted to determine the denomination and the face orientation of each of the bills;

a bill facing mechanism adapted to rotate a bill approximately 180° to reverse the face orientation of a bill; and

- 5 a controller adapted to cause the transport mechanism to direct a bill to the bill facing mechanism when the face orientation of the bill does not match a target orientation associated with the determined denomination of the bill, the controller being adapted to cause the transport mechanism to direct a bill to the output receptacle associated with the determined denomination of the bill, the controller being adapted to redefine the target  
10 orientation associated with a particular denomination after a predetermined number of bills are transported to the output receptacle associated with the particular denomination with a common face orientation.

105. The currency evaluation device of claims 103 or 104 wherein an initial target orientation is the face orientation of a first bill transported from the input  
15 receptacle.

106. The currency evaluation device of claims 103, 104, or 105 further comprising a user interface being adapted to receive operational instructions from an operator and to display information concerning the bills.

107. The currency evaluation device of claim 106 wherein the operational  
20 instructions define an initial target orientation.

108. The currency evaluation device of claims 106 or 107 wherein the operational instructions define the predetermined number.

109. The currency evaluation device of claim 103 wherein the evaluating unit is adapted to determine the denomination of the bills.

- 25 110. The currency evaluation device of claims 104 or 109 wherein the evaluating unit is adapted to determine the value of the currency bills transported to the at least one output receptacle.

111. The currency evaluation device of claims 103, 104, 105, or 106 wherein the evaluating unit is adapted to determine the authenticity of the bills.

- 30 112. The currency evaluation device of claim 103 wherein the at least one output receptacle comprises a plurality of output receptacles.

113. The currency evaluation device of claim 112 wherein the evaluating unit is adapted to determine the denomination of each of the bills and to produce a signal indicative of the determined denomination of the bill, the controller being adapted to receive the signal indicative of the determined denomination and to route the bill to a particular one of the plurality of output receptacles based on the determined denomination.

114. The currency evaluation device of claim 113 wherein the evaluating unit is adapted to produce a no call error signal when the denomination of a bill cannot be determined, the controller being adapted to receive the no call error signal and to route the bill triggering the no call error signal to a particular one of the plurality of output receptacles.

115. The currency evaluation device of claims 112 or 113 wherein the evaluating unit is adapted to determine the authenticity of each of the bills and to produce suspect document error signal when the authenticity of the bill cannot be determined, the controller being adapted to receive the suspect document error signal and to route the bill triggering the suspect document error signal to a particular one of the plurality of output receptacles.

116. The currency evaluation device of claim 104 where the controller is adapted to caused the transport mechanism to direct a bill to a particular one of the plurality of output receptacles when the evaluating unit cannot determine the denomination of the bill.

117. The currency evaluation device of claims 104 or 116 where the controller is adapted to caused the transport mechanism to direct a bill to a particular one of the plurality of output receptacles when the evaluating unit cannot determine the authenticity of the bill.

118. A currency handling device having at least one sensor adapted to detect the presence of a bill jam along a bill transport path, the device adapted to suspend operation upon detection of a bill jam.

119. A currency handling device for rapidly processing a plurality of currency bills, the device comprising:  
an input receptacle adapted to receive stacks of bills to be processed;

a plurality of output receptacles adapted to receive the bills after the bills have been evaluated, at least one of the output receptacles including a holding area and a storage area;

- 5 a transport mechanism adapted to transport the bills, one at a time, along a transport path from the input receptacle into the holding areas;

an evaluating unit adapted to determine information concerning the bills, the evaluation unit including at least one evaluating sensor positioned along the transport path between the input receptacle and the plurality of output receptacles;

- 10 a plurality of bill passage sensors sequentially disposed along the transport path, each of the plurality of sensors being adapted to detect the passage of a bill as each bill is transported past each sensor;

- a controller being adapted to track the movement of bills along the transport path, the controller adapted to separately maintain a count of the number of bills transported to the each of the holding areas and each of the storage areas, the controller being adapted to detect the  
15 presence of a bill jam and suspend operation of the transport mechanism when a bill is not transported past one of the plurality of bill passage sensors within a predetermined amount of time.

120. A currency handling device for rapidly processing a plurality of currency bills, the device comprising:

- 20 an input receptacle adapted to receive stacks of bills to be processed;

a plurality of output receptacles adapted to receive the bills after the bills have been evaluated, at least two of the output receptacles including a holding area and a storage area;

- 25 a transport mechanism adapted to transport the bills, one at a time, along a transport path from the input receptacle into the holding areas;

an evaluating unit adapted to determine information concerning the bills, the evaluation unit including at least one evaluating sensor positioned along the transport path between the input receptacle and the plurality of output receptacles;

- a plurality of bill passage sensors sequentially disposed along the transport path,  
30 each of the plurality of sensors being adapted to detect the passage of a bill as each bill is transported past each sensor;

an encoder adapted to produce an encoder count for each incremental movement of the transport mechanism; and

a controller being adapted to track the movement of bills along the transport path, the controller adapted to separately maintain a count of the number of bills transported to each of  
5 the holding areas and each of the storage areas, the controller being adapted to detect the presence of a bill jam and suspend operation of the transport mechanism when a bill is not transported past one of the plurality of bill passage sensors within a requisite number of encoder counts.

121. The currency handling device of claims 119 or 120 wherein the controller is  
10 adapted to cause the bills in each of the holding areas to be moved to the corresponding storage area after detection of a bill jam.

122. The currency handling device of claim 121 further comprising a user interface adapted to receive input from a user of the currency handling device, the controller adapted to prompt the user for input before causing the bills in each of the  
15 holding areas to be moved to the corresponding storage areas after a bill jam is detected, the controller adapted move the bills in the holding areas to the corresponding storage areas in response to user input.

123. The currency handling device of claims 121 or 122 wherein the controller is adapted to update the count of the number of bills transported into a storage area by adding  
20 thereto the count of the number of bills transported into the corresponding holding area prior to causing the bills in the holding area to be moved to the corresponding storage area.

124. The currency handling device of claim 123 wherein the controller is adapted to reset the count of the number of bills transported into the holding area after causing the bills in each of the holding areas to be moved to the corresponding storage area.

25 125. The currency handling device of claims 121, 122, or 123 wherein the controller is adapted to cause the transport mechanism to flush the bills from the transport path after causing the bills in each of the holding areas to be moved to the corresponding storage area after detection of a bill jam.

126. The currency handling device of claims 121, 122, 123, or 125 wherein the  
30 controller is adapted to cause the transport mechanism to flush the bills from the transport path after the bills in each of the holding areas are moved to the corresponding storage areas.

127. The currency handling device of claims 125 or 126 further comprising a user interface adapted to receive input from a user of the currency handling device, wherein the controller is adapted to prompt the user as whether to flush the bills, the controller being adapted to cause the transport mechanism to flush the bills in response to user input.

- 5 128. The currency handling device of claims 119, 120, or 121 wherein the controller is adapted to detect the presence of a bill jam in the holding areas, the controller adapted to suspend operation of the transport mechanism upon the detection of a bill jam in one of the holding areas, the controller being adapted to cause the bills in each of the holding areas not having a bill jam detected therein to be moved to the corresponding storage areas  
10 upon detection of a bill jam.

129. The currency handling device of claim 128 further comprising a user interface adapted to receive input from a user of the currency handling device, the controller being adapted to prompt the user as whether to flush the bills, the controller being adapted to cause the transport mechanism to flush the bills from the transport path in response  
15 to user input.

130. The currency handling device of claims 128 or 129 further comprising a user interface adapted to receive input from a user of the currency handling device, the controller adapted to prompt the user for input before causing the bills in each of the holding areas not having a bill jam detected therein to the corresponding storage areas, the  
20 controller adapted move the bills in each of the holding areas not having bill jams detected therein to the corresponding storage areas in response to user input.

131. The currency handling device of claim 130 wherein the controller is adapted to prompt the user as whether to flush the bills, the controller being adapted cause the transportation mechanism to flush the bills in response to user input.

- 25 132. The currency handling device of claims 119, 120, 121, 128 wherein the controller is adapted to electronically jog the transport mechanism to facilitate the clearing of the bill jam in response to user input via the user interface.

133. The currency handling device of claims 119, 120, 121, 128, 132, or 133 wherein the device is adapted to process bills at a rate of at least about 800 bills per minute.

- 30 134. The currency handling device of claims 119, 120, 121, 128, 132, 133, or 134 wherein the device is adapted to process bills at a rate of at least about 1500 bills per minute

135. The currency handling device of claims 119, 120, 121, 128, 132, 133, or 134 wherein each of the output receptacles including a holding area and a storage area further include a paddle adapted to move the bills from the holding area to the corresponding storage areas.

5 136. The currency handling device of claims 119, 120, 121, 128, 132, 133, 134, or 135 further comprising:

a bill facing mechanism disposed along the transport path between the evaluation region and the plurality of output receptacles, the bill facing mechanism being adapted to rotate a bill approximately 180°;

10 a plurality of bill passage sensors sequentially disposed along the bill facing mechanism; and

wherein the controller is adapted to detect a bill jam within the bill facing mechanism.

137. The currency handling device of claim 119 further comprising an encoder  
15 adapted to generate an encoder count for each incremental movement of the transport mechanism.

138. A method for processing currency bills with a currency handling device, the method comprising:

receiving a plurality of bills in an input receptacle;

20 transporting the bills with a transport mechanism, one at a time, from the input receptacle along a transport path into a plurality of output receptacles, at least one of the plurality of the output receptacles including a holding area and a storage area;

determining information concerning the bills with an evaluating unit;

25 maintaining a count of the total number of bills transported into each of the holding areas;

moving the bills transported into each of the holding areas into a corresponding storage area after a predetermined number of bills have been stacked in the holding area;  
maintaining a count of the total number of bills moved into each of the storage areas;  
tracking the movement of each of the bills along the transport; and

30 detecting the presence of a bill jam when a bill is not transported past a predetermined position along the transport path within a predetermined amount of time.



139. The method of claim 138 wherein determining information further comprises determining information concerning the bills with the evaluating unit at a rate of at least about 800 bills per minute.

140. The method of claims 138 or 139 wherein determining information further comprises determining information concerning the bills with an evaluating unit at a rate of at least about 1500 bills per minute.

141. The currency handling device of claims 138, 139, or 140 further comprising:  
reversing the face orientation of a bill where the face orientation of a bill does not match a target orientation with a bill facing mechanism; and  
10 detecting the presence of a bill jam in the bill facing mechanism when a bill is not transported past one of the plurality of bill passage sensors within a requisite number of encoder counts with a plurality of bill passage sensors sequentially disposed along the bill facing mechanism.

142. The method of claims 138, 139, 140, or 141 further comprising suspending  
15 operation of the transport mechanism upon detection of a bill jam.

143. The method of claim 142 further comprising moving the bills already transported into each of the holding areas to the corresponding storage areas upon suspension of the operation of the transport mechanism.

144. The method of claim 143 further comprising updating the count for each of the  
20 storage areas of the number of bills moved into each of the storage areas by adding thereto the count of the number of bills transported into the corresponding holding areas prior to moving the bills from each of the holding areas to the corresponding storage areas upon suspension of the operation of the transport mechanism.

145. The method of claim 144 further comprising resetting the count of the total  
25 number of bills transported into each of the holding areas

146. The method of claims 143 or 144 further comprising receiving input from a user of the currency handling device via a user interface, the input including operational instructions, and wherein moving the bills already transported into each of the holding areas to the corresponding storage areas further comprises moving the bills already transported into  
30 each of the holding areas to the corresponding storage areas after suspension of the operation of the transport mechanism in response to user input.

147. The method of claims 143, 144, or 146 further comprising flushing the bills from the transport path after moving the bills already transported into each of the holding areas to the corresponding storage areas.

148. The method of claim 147 further comprising receiving input from a user of the currency handling device via a user interface, the input including operational instructions, and wherein flushing the bills further comprises flushing the bills in response to user input.

149. The method of claims 143, 144, 146, or 147 further comprising detecting the presence of a bill jam in one of the holding areas when a bill is not transported past a predetermined position within the holding area within a predetermined amount of time, and wherein moving the bills already transported into each of the holding areas further comprises moving the bills already transported into each of the holding areas not having a bill jam detected therein to the corresponding storage areas upon suspension of the operation of the transport mechanism.

150. The method of claim 149 further comprising receiving input from a user of the device via a user interface, the input including operational instructions, and wherein moving the bills already transported into each of the holding areas not having a bill jam detected therein further comprises moving the bills already transported into each of the holding areas not having a bill jam detected therein to the corresponding storage areas upon suspension of the operation of the transport mechanism in response to user input.

151. The method of claim 150 further comprising flushing the bills from the transport path after moving the bills already transported into the holding areas upon suspension of the operation of the transport mechanism in response to user input.

152. The method of claim 150 or 151 wherein transporting the bills further comprises stacking the bills in each of the holding areas.

153. The method of claim 150, 151, or 152 wherein tracking the movement of each of the bills further comprises tracking the movement of each of the bills along the transport path with a plurality of bill passage sensors, each of the plurality of sensors being adapted to detect the passage of a bill as each bill is transported past each sensor.

154. The method of claim 153 further comprising generating an encoder count for each incremental movement of the transport mechanism.

155. The method of claim 154 further comprising detecting the presence of a bill jam when a bill is not transported past one of the plurality of bill passage sensors within a requisite number of encoder counts.

156. A currency handling device having a plurality of output receptacles, wherein  
5 one or more of the plurality of output receptacles are adapted to be disabled.

157. A currency handling device having a plurality of output receptacles and means for disabling one or more of the plurality of output receptacles.

158. A currency handling device for rapidly processing a plurality of currency bills, the device comprising:

- 10 an input receptacle adapted to receive the currency bills to be processed;
- a plurality of output receptacles adapted to receive the bills after the bills have been evaluated;
- a transport mechanism adapted to transport the bills, one at a time, along a transport path from the input receptacle to the plurality of output receptacles;
- 15 an evaluating unit adapted to determine information concerning the bills, the evaluating unit including at least one sensor positioned along the transport path; and
- a controller adapted to operate the currency handling device according to a mode of operation wherein the mode of operation designates the output receptacle to which each of the bills are to be transported based on determined information concerning the bill, the controller  
20 being adapted to disable at least one of the plurality of output receptacles, the controller being adapted to cause the transport mechanism to redirect bills directed to the disabled one of the plurality of output receptacles pursuant to the mode of operation to an alternative output receptacle.

159. The currency handling device of claim 158 wherein the controller is adapted to  
25 detect the presence of an error condition in at least one of the plurality of output receptacles.

160. The currency handling device of claim 159 wherein the controller is adapted to disable an output receptacle having an error condition detected therein.

161. The currency handling device of claim 160 further comprising a user interface adapted to receive input from a user of the currency handling device, the controller being  
30 adapted to disable an output receptacle having an error condition detected therein in response to user input.

162. The currency handling device of claim 161 further comprising a user interface adapted to receive input from a user of the currency handling device specifying the mode of operation from a plurality of modes of operation.

163. The currency handling device of claims 158 or 159 comprising a user interface  
5 adapted to receive input from a user specifying the output receptacles to be disabled.

164. The currency handling device of claim 163 further wherein the user interface is adapted to receive input from a user specifying which of the plurality of output receptacles is the alternative output receptacle.

165. The currency handling device of claims 158, 159, or 163 wherein the  
10 alternative output receptacle is the output receptacle to which no call bills are transported pursuant to the mode of operation.

166. A method of processing a plurality of currency bills with a currency handling device, the method comprising:

15       disabling at least one of a plurality of output receptacles;  
      receiving a plurality of currency bills in an input receptacle;  
      transporting the bills with a transport mechanism, one at a time, from the input receptacle past an evaluating area to the plurality of output receptacles;  
      determining information concerning each of the bills with an evaluating unit;  
      designating the particular one of the plurality of output receptacles to which each of  
20 the bills are transported based on the determined information concerning each of the bills;  
      comparing the designated output receptacle for each of the bills to the disabled output receptacle; and  
      re-designating the particular one of the plurality of output receptacles to which each of the bills are transported to an alternative output receptacle when the designated output  
25 receptacle is the disabled output receptacle.

167. A method of processing a plurality of currency bills with a currency handling device, the currency handling device including a transport mechanism adapted to transport each of the bills, one at a time, from an input receptacle past an evaluation unit to a plurality of output receptacles, the currency handling device includes a user-interface  
30 adapted receive input from a user of the currency handling device, the method comprising:

      disabling at least one of a plurality of output receptacles;

- receiving a plurality of currency bills;  
transporting the bills from the input receptacle past the evaluating unit to the plurality of output receptacles;  
determining information concerning each of the bills;  
5 designating the particular one of the plurality of output receptacles to which each of the bills are transported based on the determined information concerning each of the bills;  
comparing the designated output receptacle for each of the bills to the disabled output receptacle; and  
re-designating the particular one of the plurality of output receptacles to which each of  
10 the bills are transported to an alternative output receptacle when the designated output receptacle is the disabled output receptacle.

168. A method of processing a plurality of currency bills with a currency handling device, the currency handling device including a transport mechanism adapted to transport each of the bills, one at a time, from an input receptacle past an evaluation unit  
15 to a plurality of output receptacles, the currency handling device includes a user-interface adapted receive input from a user of the currency handling device, the method comprising:

- disabling at least one of a plurality of output receptacles;  
updating at least one output receptacle designation of a mode of operation to  
20 direct those bills designated to be delivered to the at least one disabled output receptacle to an alternative output receptacle;  
receiving a plurality of currency bills;  
transporting the bills from the input receptacle past the evaluating unit to the plurality of output receptacles;  
25 determining information concerning each of the bills; and  
designating the particular one of the plurality of output receptacles to which each of the bills are transported based on the determined information concerning each of the bills.

169. The method of claims 166, 167, or 168 further comprising detecting the presence of an error condition within the plurality of output receptacles.

- 30 170. The method of claim 169 wherein disabling further comprises disabling the output receptacle having an error condition detected therein.

171. The method of claim 170 further comprising disabling the output receptacle having an error condition detected there in response to user input.

172. The method of claim 166 wherein the currency handling device includes a user interface, and wherein disabling further comprises disabling the output receptacle having an error condition detected therein in response to user input.

173. The method of claims 166, 167, 168, 169, or 172 further comprising receiving input from a user of the currency handling device selecting a mode of operation from a plurality of modes of operation stored within a memory of the currency handling device, wherein the mode of operation designates the one of the plurality of output receptacles to which each of the bills are transported based on the determined information concerning the bill.

174. The currency handling device of claim 173 wherein the alternative output receptacle is the output receptacle to which no call bills are transported pursuant to the specified mode of operation.

175. The method of claims 166, 167, 168, 169, 172, 173, or 174 further comprising receiving input from a user of the currency handling device specifying the particular one of the plurality of output receptacles to be disabled.

176. The method of claims 166, 167, 168, 169, 173, 174, or 175 further comprising receiving input from a user of the currency handling device specifying which of the plurality of output receptacles is the alternative output receptacle.

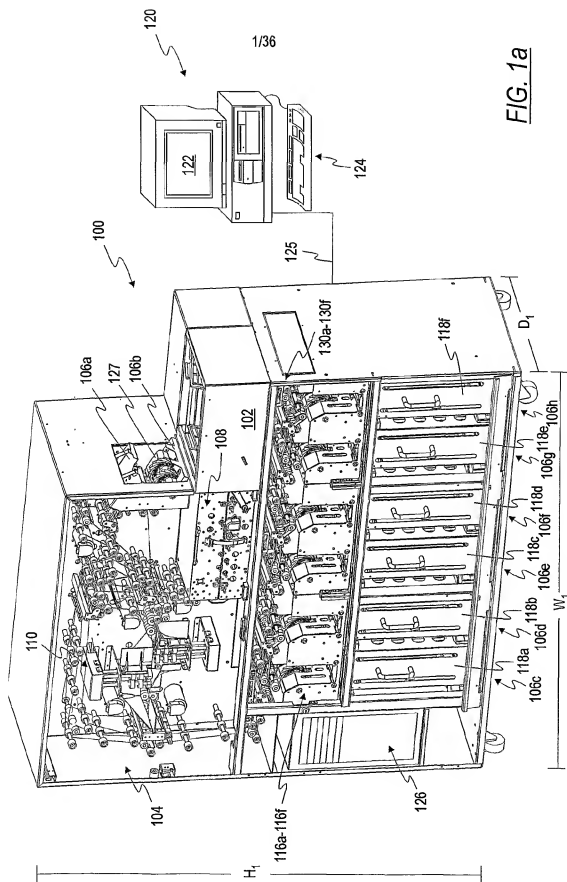
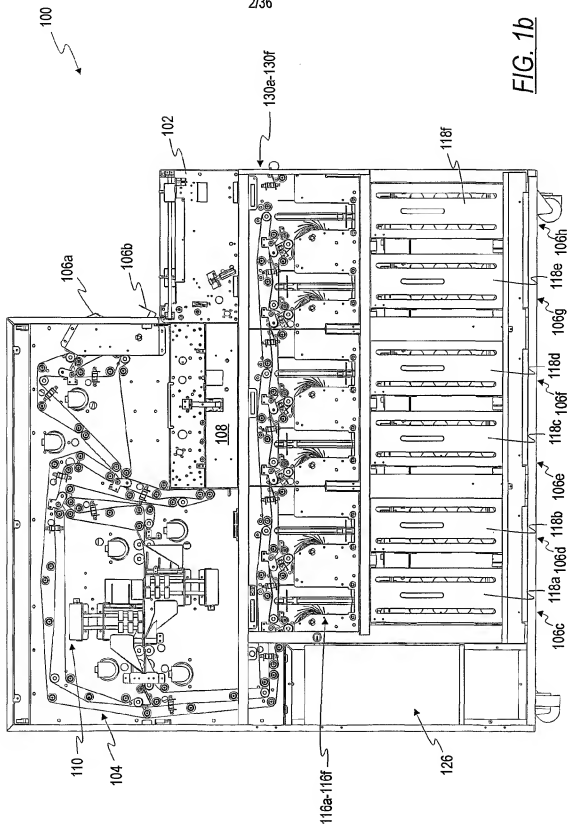


FIG. 1a

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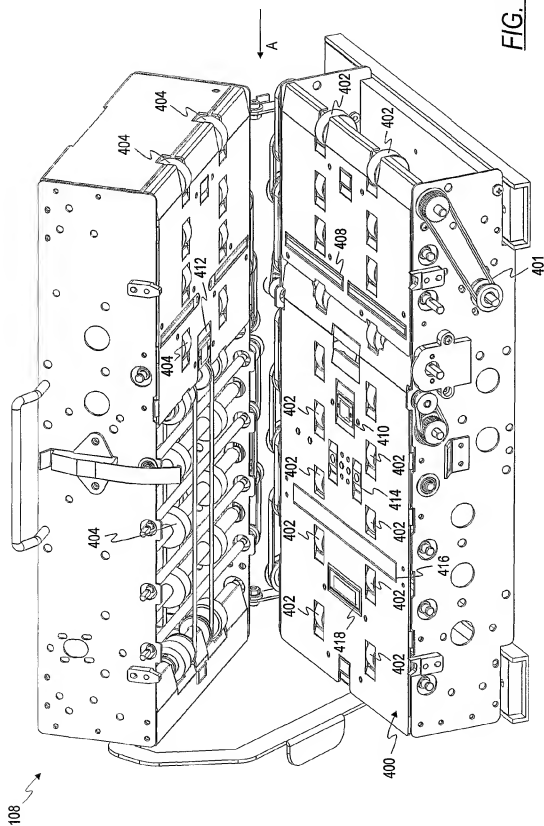


FIG. 2a

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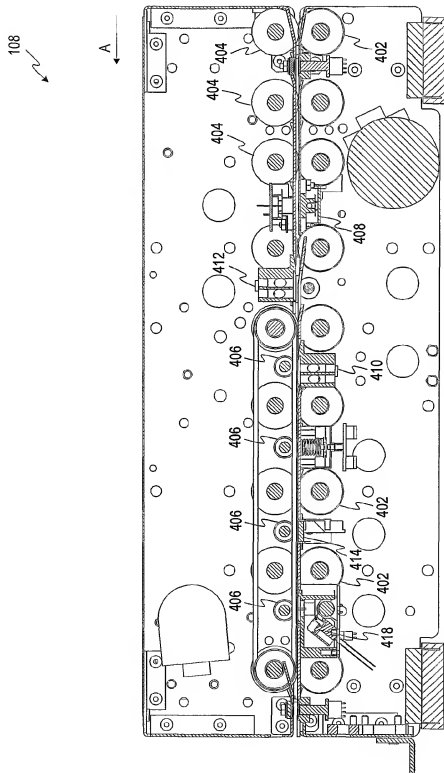


FIG. 2b

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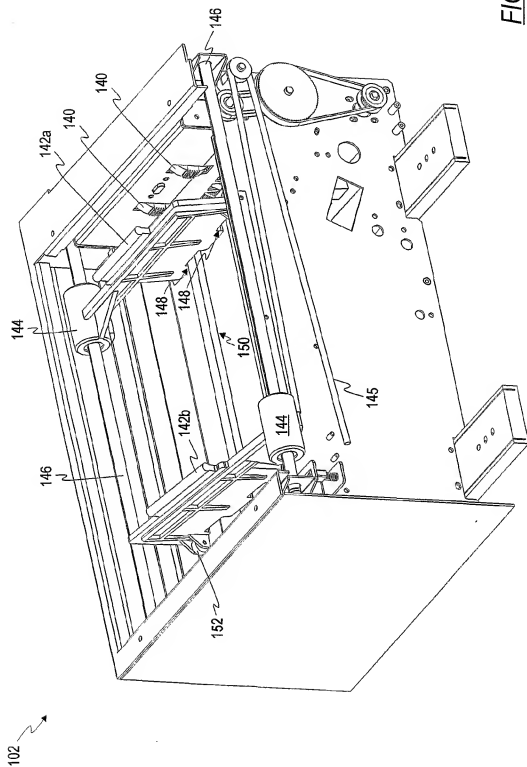
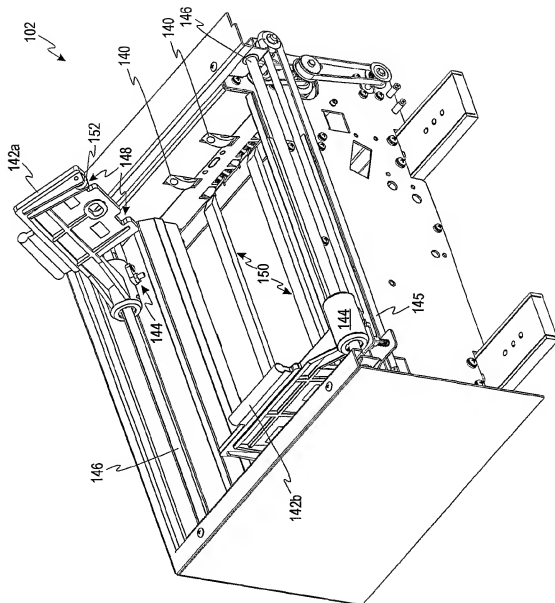


FIG. 3a

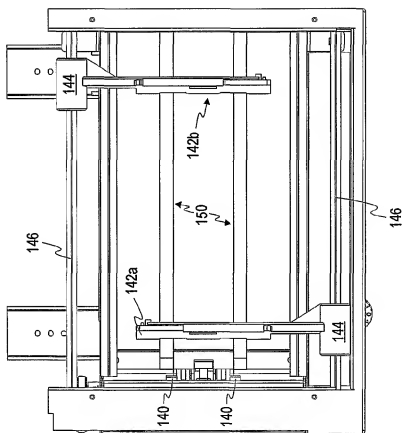
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FIG. 3b

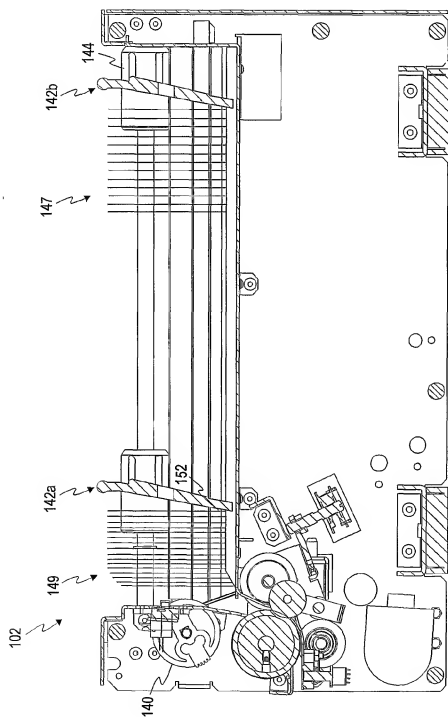
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FIG. 3c

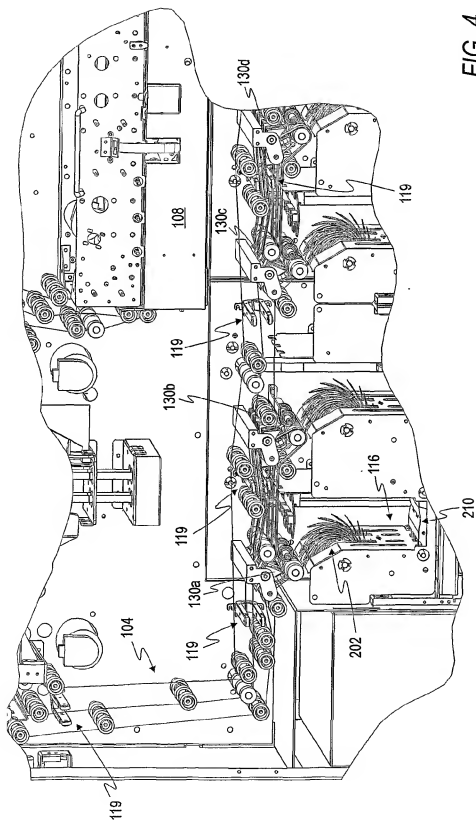
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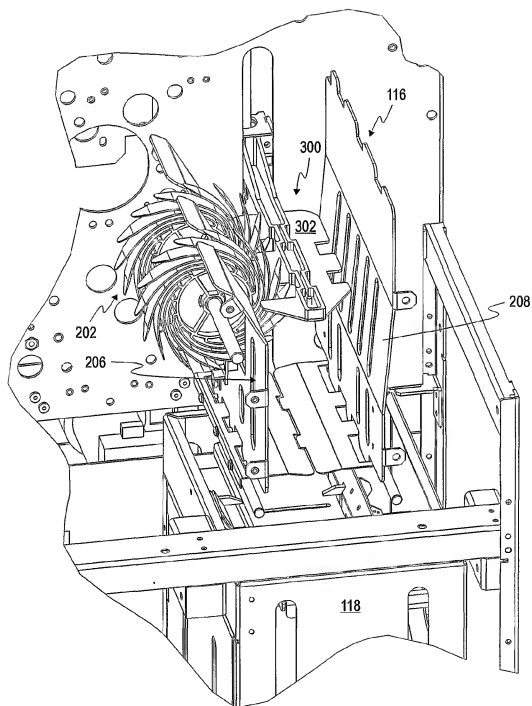
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FIG. 3d

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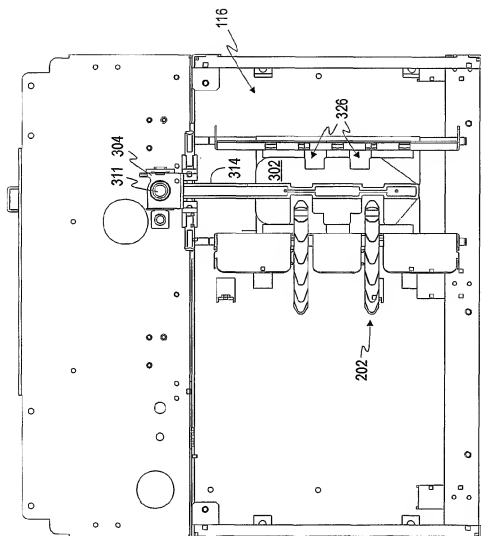
FIG. 4

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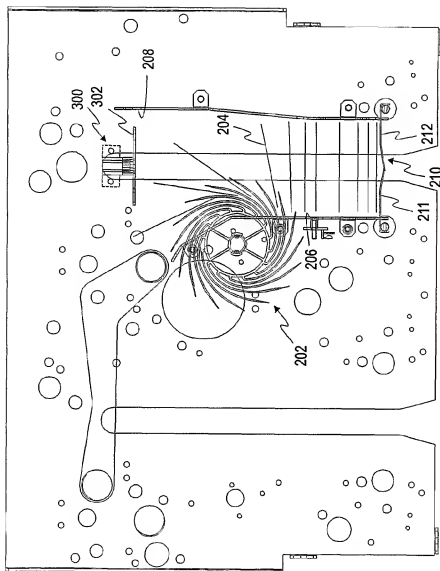
*FIG. 5*



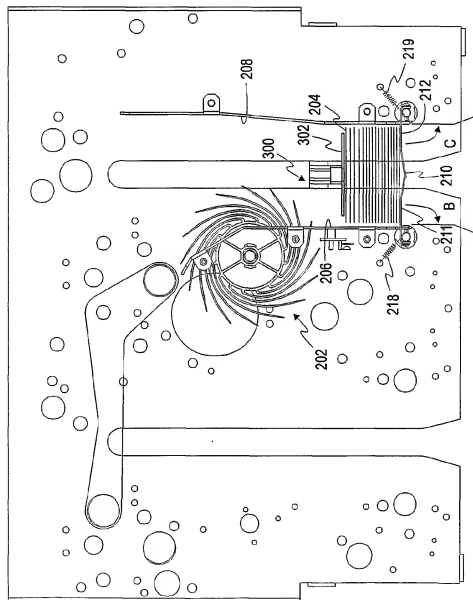
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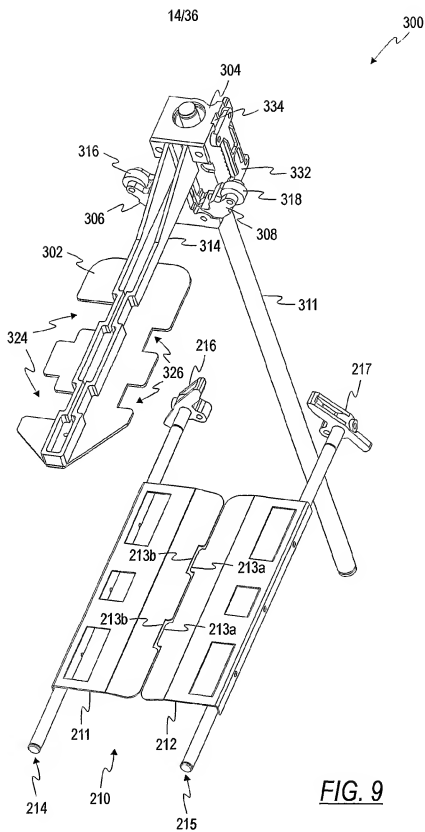
FIG. 6

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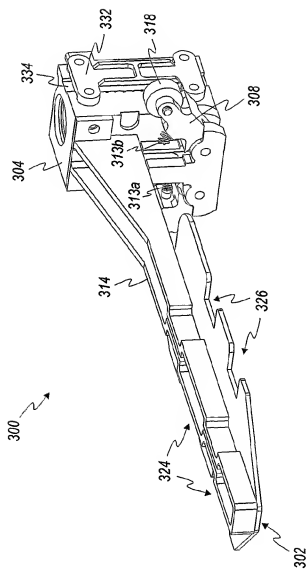
FIG. 7

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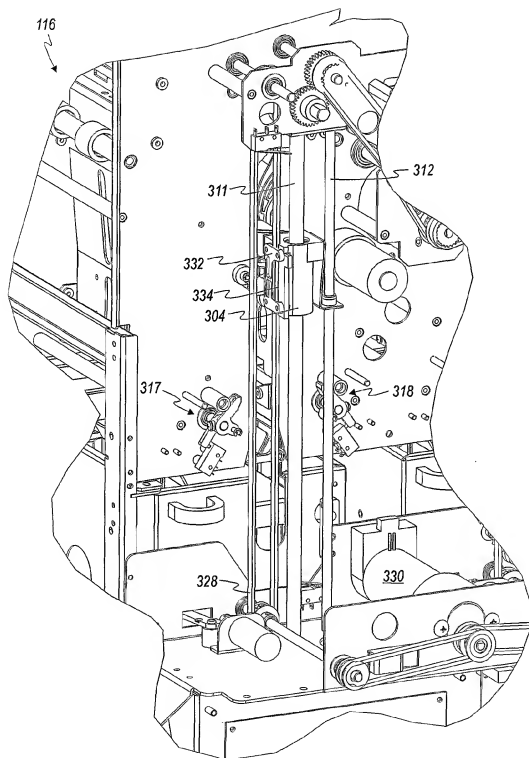
FIG. 8



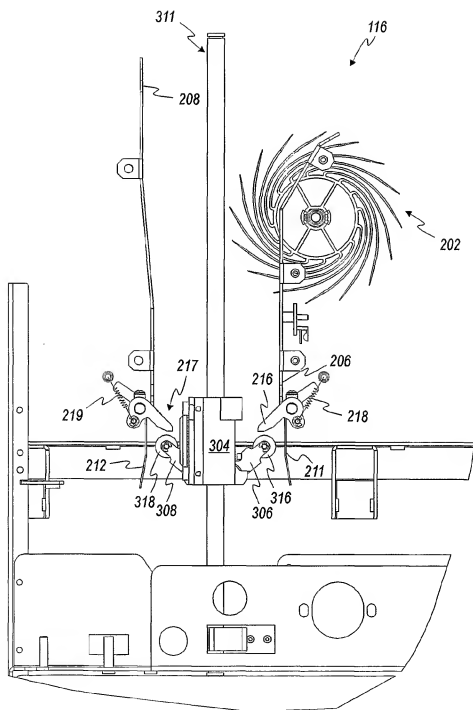
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FIG. 10

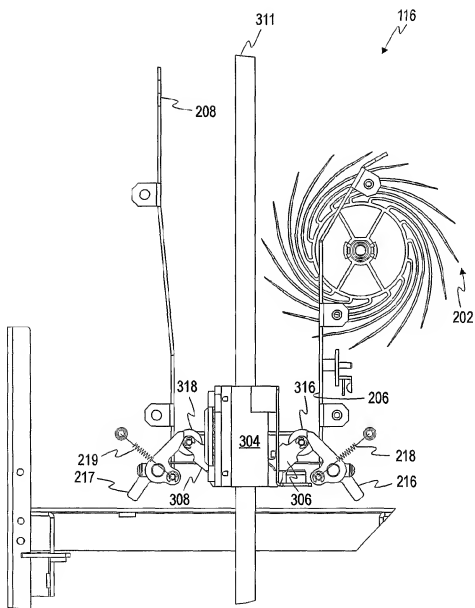
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FIG. 11

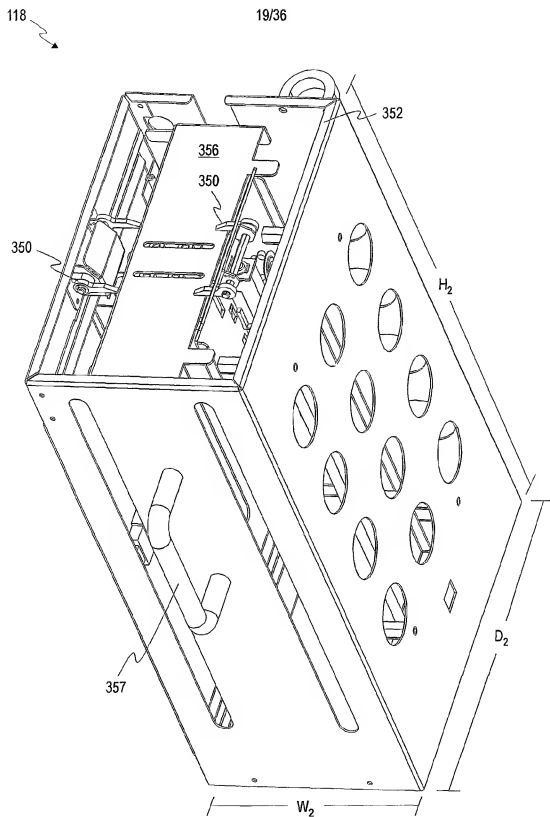
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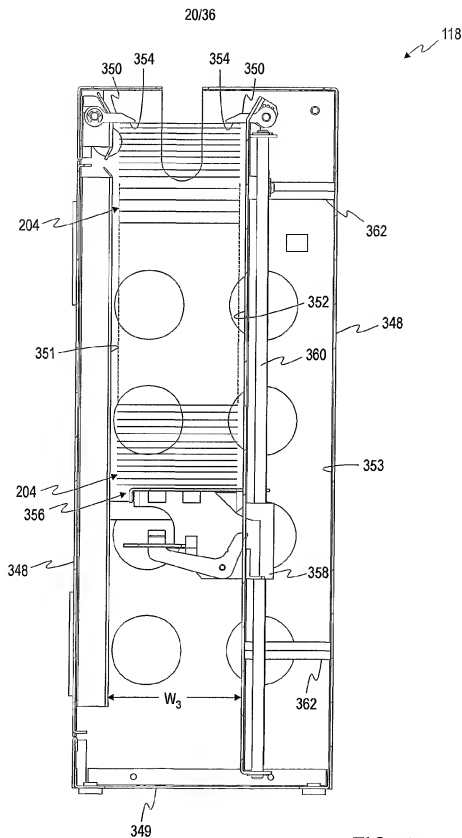
**FIG. 12**

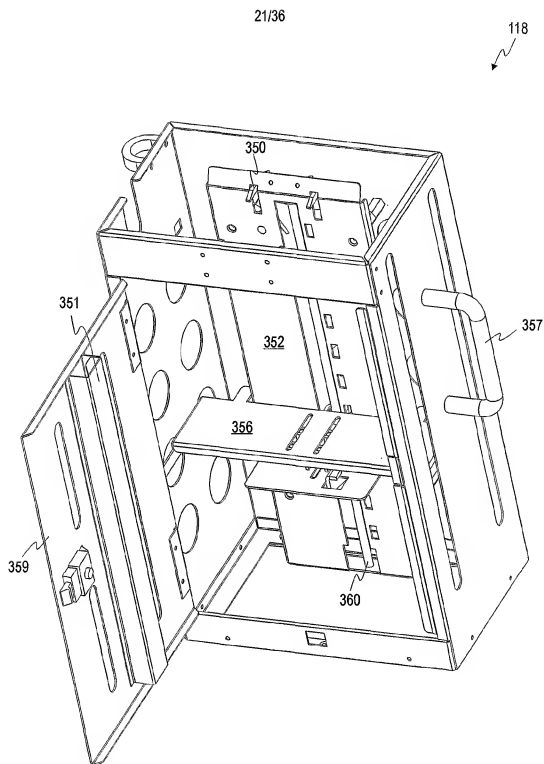
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FIG. 13



**FIG. 14**



FIG. 16

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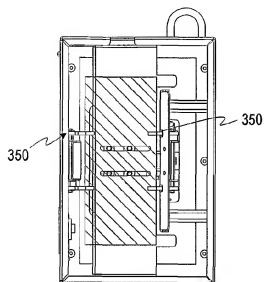


FIG. 17a

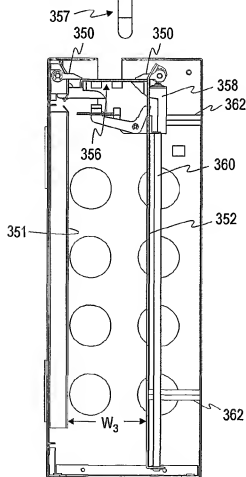
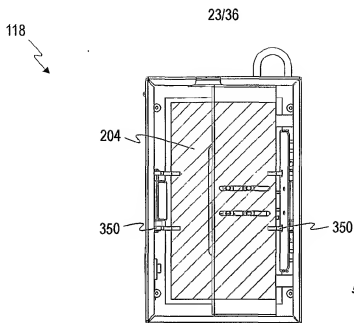
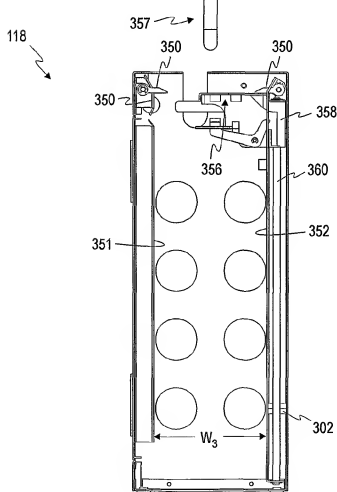


FIG. 17b

FIG. 18aFIG. 18b

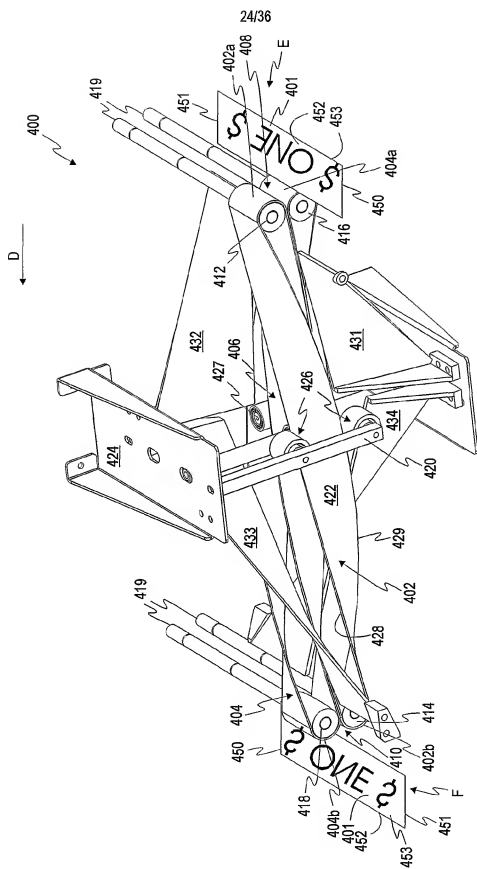


FIG. 19

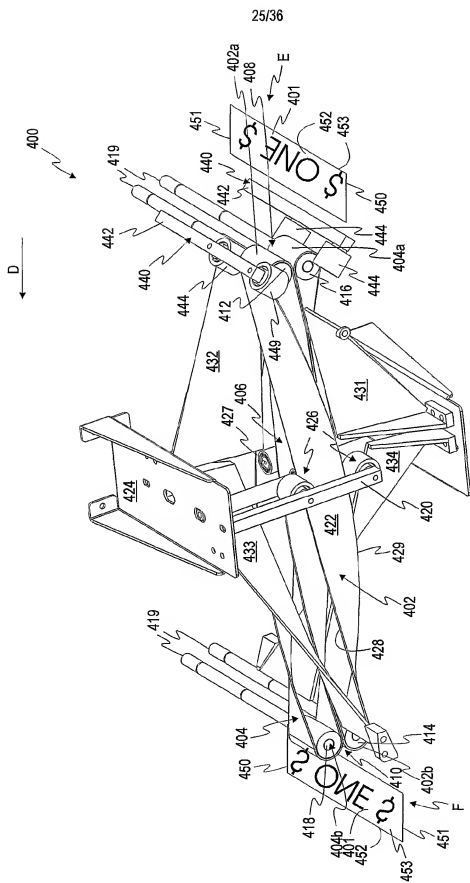


FIG. 20

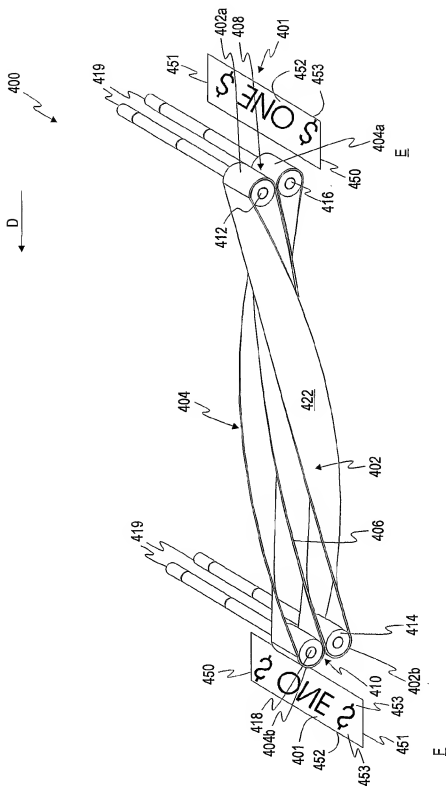
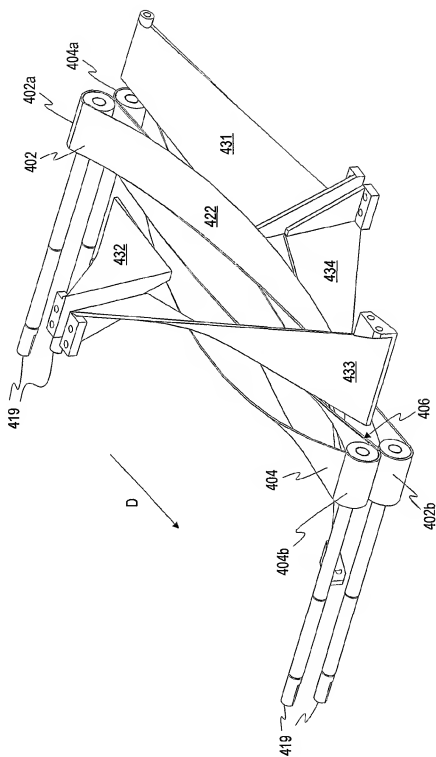


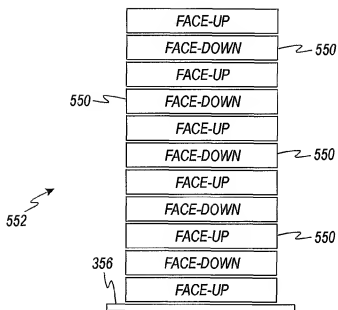
FIG. 21

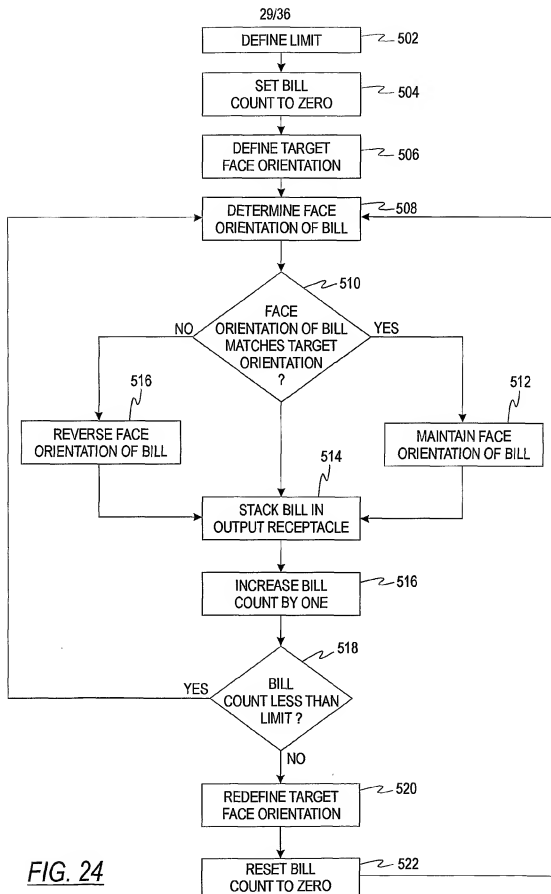


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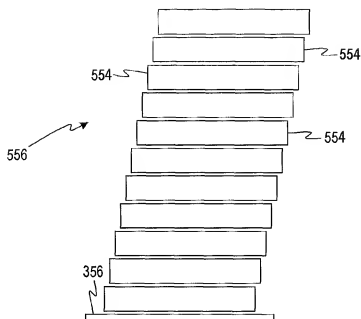
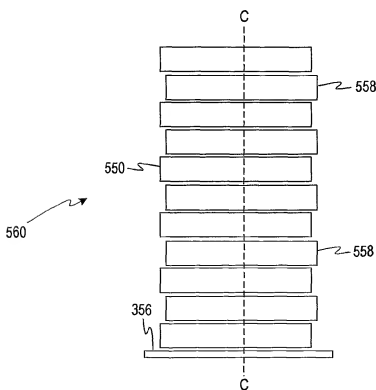
FIG. 22

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FIG. 23



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FIG. 25aFIG. 25b

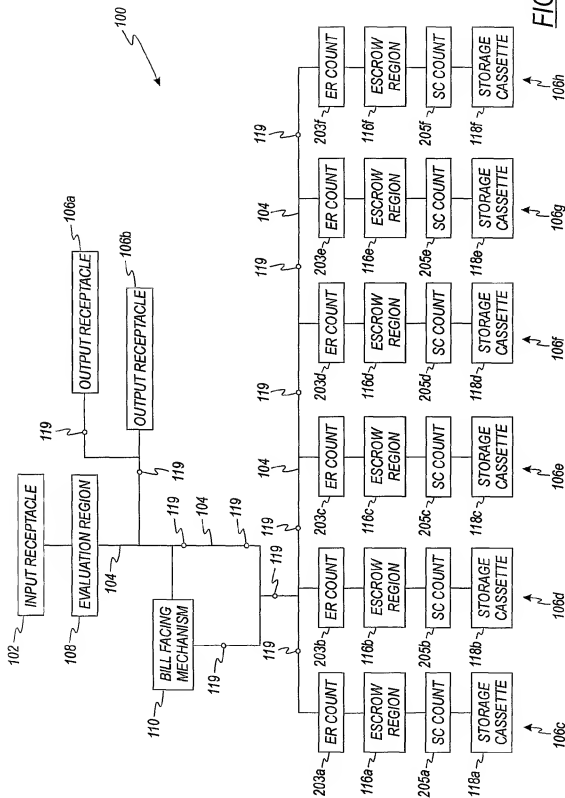
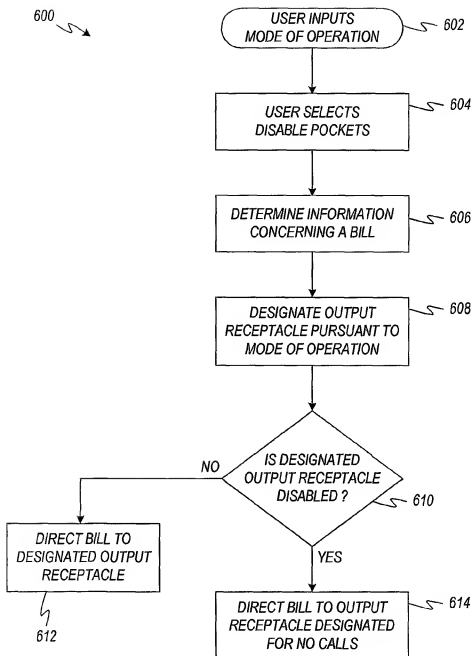
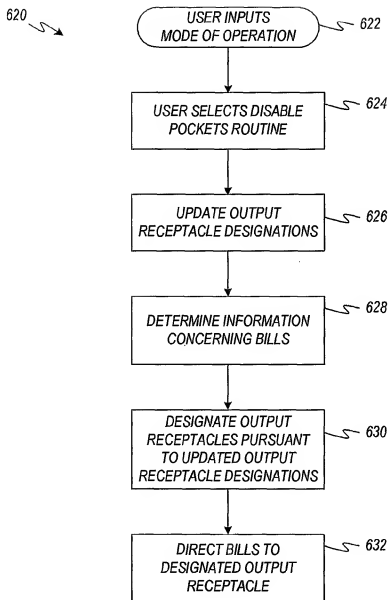


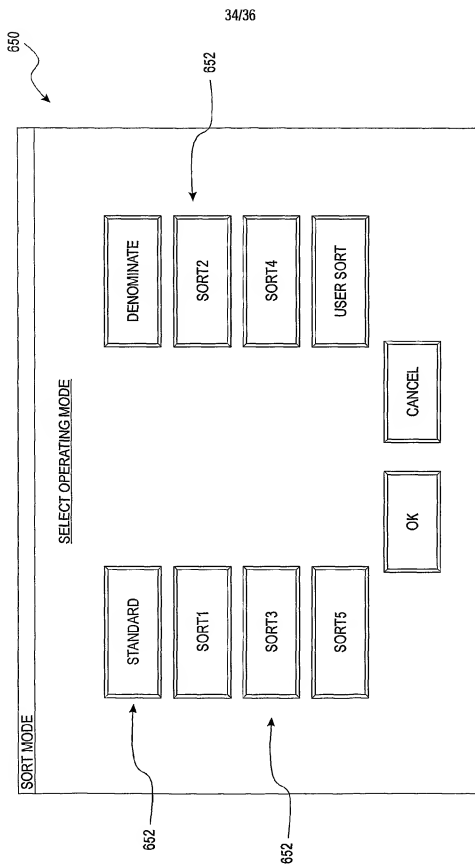
FIG. 26

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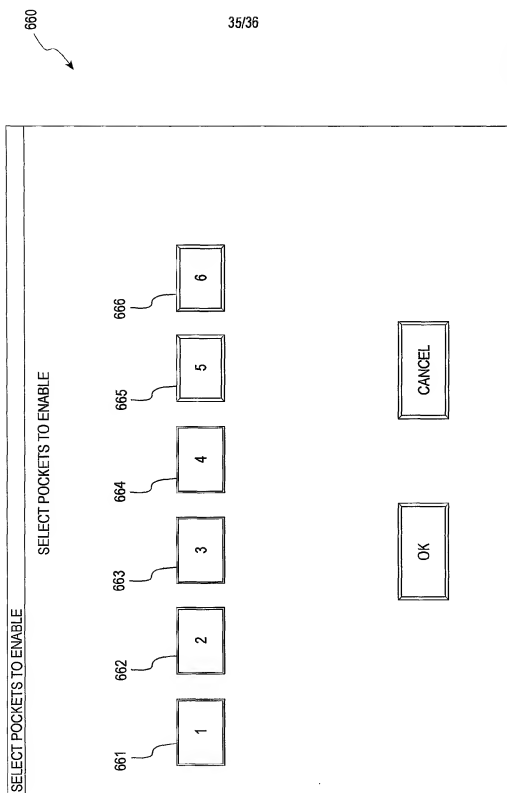
FIG. 27

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FIG. 28

FIG. 29



FIG. 30

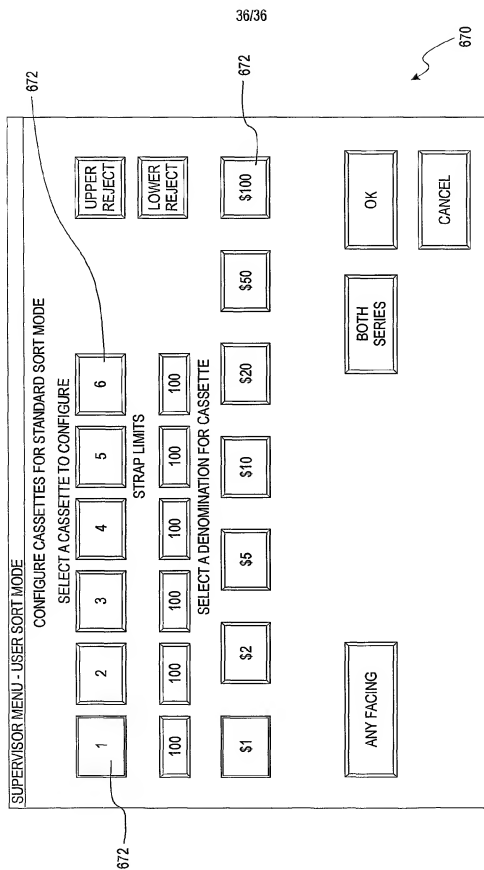


FIG. 31

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/04154

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G07F 7/04; B65H 1/02, 1/26; B65G 57/00  
 US CL : 194/206; 271/149, 157; 414/790.5

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 194/206, 207, 200; 209/534; 221/242; 271/31.1, 149, 157, 158, 180, 181; 414/790.3, 790.5, 790.8

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,993,132 A (HARRES et al) 30 November 1999 (30.11.1999), column 14, lines 19-65	49-68
A	US 5,915,685 A (BAUSCH et al) 29 June 1999 (29.06.1999), column 2, lines 42-55.	49-68
X	US 5,829,742 A (RABINDRAN et al) 03 November 1998 (03.11.1998), column 9, lines 15-65.	49-68
A	US 5,232,216 A (BYBEE) 03 August 1993 (03.08.1993), column 6, lines 11-57.	41-48, 119-176
A	US 4,917,371 A (BASTOW et al) 17 April 1990 (17.04.1990), column 10, lines 35-62.	41-48, 119-176
Y	US 4,804,998 A (MIYAWAKI) 14 February 1989 (14.02.1989), column 3, lines 14-22.	41-48
---		119-176
A		119-176
A	US 4,629,382 A (UESHIN) 16 December 1986 (16.12.1986), column 11, lines 25-62.	1-40
Y	US 4,479,049 A (HIROSE) 23 October 1984 (23.10.1984), column 3, lines 16-50.	41-48
---		119-176
A		119-176

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

20 April 2001 (20.04.2001)

Date of mailing of the international search report

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